Railway Mechanical Engineer

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Charting Shop Organizations

The practice of drawing up charts showing the type of organization and manner of control has been common to industrial concerns for a number of years. Because of the type and character of work performed in the average railroad shop, the practice of charting such organizations has been limited to the larger railroads. In many shops the duties and scope of each officer, foreman and workman have been explained when they first start in the work of a new position, or in many instances the individual already knows from previous experience in the organization the scope and limits of activity of the new position that he is about to step into. Every now and then someone oversteps his authority and if this happens too frequently, friction between individuals and departments is bound to occur. It is not difficult to work up a chart showing the relationship between departments, the scope of activities and the limits of authority of various officials and department heads. Keeping such charts up-to-date will show up the weaknesses and shortcomings of the organization and indicate possible procedure to remedy such defects. Organization charts posted in offices and at various places throughout the shop will give the official and the men a visual understanding of what their duties are and their relationships to one another. Charts also tend to arouse a feeling of confidence in officers and men. They will shed light on many phases of shop organization and management that otherwise might remain in the dark.

Check Your Machine Operations

It will pay our readers to study carefully the report of the General Foremen's convention published elsewhere in this issue. The convention was addressed by James C. Davis, director general of railroads, and was highly inspirational in making foremen appreciate the importance of personnel problems and seeing beyond their own particular departments. In addition, many more tangible, if perhaps less generally important, practical suggestions were made regarding shop methods and devices.

In discussing machine shop work, Karl Berg, superintendent of the McKees' Rocks locomotive shops of the Pittsburgh & Lake Erie, said in effect that *foremen should constantly question if present machine methods are most economical.* This advice is sound and should be taken to heart by railroad shop foremen because, as pointed out by Mr. Berg, labor prices are subject to change; material prices are constantly changing; what is economical machine practice today may be costly practice tomorrow. The margin between what it costs a railroad to make certain articles or to purchase them is frequently small and, without a constant check on costs, articles may continue to be made in local shops when they could be bought for less money.

Mr. Berg also commented emphatically on several phases of the shop equipment situation to which the *Railway Mechanical Engineer* has given considerable attention in recent months. He explained the need of most railroad shops for more modern machine tools and labor-saving equipment in view of present high labor costs. He advised the more general use of manufacturing methods in large shops and centralized production departments where the manufacture and assembly of interchangeable parts present marked opportunities for economy. This is plainly a vital point and one deserving more attention in the future than it has received in the past. Not only can specialized high production machinery thereby be used with a favorable reduction in cost, but having these parts finished or semi-finished in advance insures the return of bad-order equipment to service with a minimum delay.

Elimination of Waste—Competition

Just three elements enter into the product of industry, whether it be manufactured articles, such as furniture and automobiles, or repaired and rebuilt locomotives and cars. They are material, the use of facilities, and labor. All three elements are placed at the disposal of the supervisor and the cost of his output depends on the efficiency with which he uses them. The last two resolve themselves into the use of time—the time of machines and the time of men. There are great possibilities for reducing waste in all three of these elements. Some of the causes of waste, particularly in the time element, are, it is true, not within the control of the railroads and certainly not within the control of the individual foreman or shop executive. The problem of unemployment created by periodical depressions, for instance, is one which will require the co-operative action of every part of our entire industrial system. But is there a railroad shop in which there are not still many opportunities for the better utilization of the time of facilities, or for making the time of employees more effective? Few shops have as extensive crane facilities as might be desired. Is it not possible, for instance, that a slight reorganization of the operations depending on crane service may reduce the waste of the time of these facilities at certain idle periods and make them much more effective? Are there not numerous cases where a few simple special tools or jigs have effected a marked conservation in the time of a lathe, a planer, a shaper, or a milling machine, as well as the time of the men operating it and the time of others whose work depends upon its output? Are there not also still many opportunities for reducing the waste of material, either by reclamation or by better shop practice? These examples do not begin to cover the wide range of opportunities that no doubt will suggest themselves to every one of our readers. What has been done in one shop may be highly suggestive of opportunities still available for further improvement in some other equally well managed shop. Therefore, to answer these questions and to make our columns a clearing house for the most productive methods of conserving material and time, we are offering a first prize of $50 and a second prize of $35

for the two best articles received on or before November 15, telling of actual instances of the elimination of such wastes. The prizes will be awarded on the basis of the constructive value of the suggestions contained in the articles submitted. The articles should be specific and accompanied by illustrations wherever possible. Articles to which prizes are not awarded, but which are used in our columns, will be paid for at space rates. Don't miss this opportunity to be of real service to your industry.

What About the Standard Box Cars?

The attempt to establish standard box car designs, with the single exception of the establishment of uniform standard time, is probably the biggest project ever undertaken by the American railways, acting together voluntarily through the American Railway Association. The project has now been brought to completion in the standard box car designs placed before the Mechanical Division at its annual meeting in June, and it only remains to be seen whether or not the effort has been in vain after the returns from the letter ballot now in the hands of the members have been counted.

It is not the purpose of the *Railway Mechanical Engineer* to enter into a discussion of the details of the design. As stated in these columns last month, no question has been raised but that the general designs will produce good cars. Just how good, relatively, will remain a matter of controversy until the question is settled by experience over a considerable period of service with large numbers of the cars built from these designs. It is evident beyond a doubt, however, that the designs do represent a balancing of the various opinions as to what are the most important requirements to be met in box car construction, including such factors in the problem as price, strength and weight. The members of the committee that developed and presented these designs were chosen to represent all sections of the United States and Canada, and collectively represent the ownership of at least two-thirds of the freight car equipment of America. Furthermore, on this committee were representatives of railroads that are diametrically opposed in their policy with respect to the relative importance of the greatest strength on one hand and the least possible weight on the other. It may be concluded, therefore, that the acceptance of the designs as they now stand will require as little compromise on the part of the members of the American Railway Association as any designs that could be developed by the Car Construction Committee, either with its present or an entirely new personnel.

In voting for or against the adoption of these designs, the question is not one to be settled purely on the basis of the selfish interests of each railroad. The real question is what advantages do these designs offer to the railroads as a whole in return for the sacrifice of certain individual opinions as to the merits of the details of the committee's designs.

In the first place, it offers the large number of railroads that have no mechanical engineering departments, or departments of limited capacity, highly developed designs from which cars can be secured advantageously in numbers large or small. In time the use of these designs by such roads will relieve the large systems handling traffic in heavy volume of much of their present difficulty with weak cars in interchange. Their use will also ultimately greatly facilitate the shopping of cars whenever and wherever they need attention away from home.

But, considering the matter from the interests of the individual railroads, the proposed designs give practically unrestricted freedom to each railroad in the selection of specialties. This leaves the field open for free competition in the commercial development of the important details, such as roofs, ends, draft gears, and the truck details which have not already been standardized. This is important to the railroads collectively as well as individually since dependence must be placed on the companies in the supply field for the commercial development of improvements in all these important details, even though the ideas for the improvements may originate in the railroad service.

The *Railway Mechanical Engineer* believes that the interests of the railroads as a whole can best be served by the adoption of these designs. The railroads will thereby have accomplished their long established purpose and will have demonstrated their ability to co-operate toward constructive ends. With this ability demonstrated, a standard design for other types of cars, such, for instance, as the double-sheathed box car of composite construction, can be developed by the Car Construction Committee with reasonable assurance that such further effort will not be wasted.

The Apprentice Competition

The two apprentice competitions, one for regular apprentices and the other for specials, or college graduates, closed on September 1. Both of them were a decided success. No competition that we have ever held has brought out as many contributors as did the competition for the regular apprentices. Because of the great number of manuscripts which were received the judges have as yet been unable to make a decision as to the prize winners for this class.

Naturally, fewer contributions were received in the competition for special apprentices. The judges have awarded the first prize to Dale C. Sheffield, a special apprentice on the Chicago, Milwaukee & St. Paul at Bedford, Ind., and a graduate from the engineering department of Montana State College. The second prize goes to Roy Eckart, a special apprentice with the Atchison, Topeka & Santa Fe, at Raton, N. M., and a graduate of the Kansas State Agricultural College. Two other contributors pushed Mr. Eckart so hard for second place that the judges have asked that they be given honorable mention. These men are Alfred H. Burnham, Jr., special apprentice on the Baltimore & Ohio, at the Mt. Clare shops, Baltimore, Md., and a graduate of the School of Engineering of Johns Hopkins University; and E. B. Fields, a special apprentice on the Atchison, Topeka & Santa Fe at Albuquerque, N. M., and a graduate of the mechanical engineering department of Pennsylvania State College.

All four of these articles will be published in the *Railway Mechanical Engineer.* Some of the suggestions which are made are excellent and should help the railroads to make better use of college graduates. The contribution by Mr. Burnham will be found elsewhere in this issue. It is published first, and before the prize winning contributions, only because the illustrations for use with the other articles were delayed and those for Mr. Burnham's article were the first to come to hand.

If Mr. Burnham's point of view is a typical one for recent graduates from schools of engineering, it would indicate that a considerable change has taken place in transferring the emphasis in university engineering training from purely technical things to those which concern the human element. There is no question but that the last quarter of a century has shown a marked change in this respect and it argues well for the future. If the college trained man is to go to the top and exert the influence which he should in railroading, he must have a thorough appreciation of this whole problem of human relations in industry. It is important, also, that those who have to do with the training of college men on our railroads should appreciate this modern point of view.

The practical suggestions in the contributions all indicate that the special apprentices are ready to accept a larger responsibility than is usually placed upon them. They feel that their training is such as to entitle them to this, at least

if they are to be developed as quickly and as broadly as would seem advisable in the best interests of the railroads. Might it not be a good idea if those who have charge of the development of college trained men, were to spend some time in finding out just what training they have received at college and just how this can best be supplemented on the railroads, in order to make the best use of them? Some of us who were graduated from college not so many years ago, do not recognize the changes and improvements that have been made in engineering college courses in recent years. Possibly the suggestions which will be found in the four articles from the special apprentices, which will be published in this and succeeding issues, will help to give a better idea of how these young men are being prepared in these days.

Standard Cutting Tools

Two of the most important points brought out in the International Railway Tool Foremen's convention, are the need for greater production in railroad shops, and the toolroom's function in providing proper tools so that this high production can be obtained. Tool foremen ordinarily are not credited with much interest in shop output and it was especially gratifying, therefore, to note how many members of the association commented on the need of co-operation with all the other shop departments in developing tools and jigs which will speed up the work. Obviously, no railroad shop can function as efficiently as it might with any single department failing to measure up to its share of the responsibility.

Railroad shop toolrooms, as pointed out by several tool foremen, can be a vital factor in the output, particularly of machine departments, by supplying sharp cutting tools for lathes, planers, shapers, etc., ground to the correct shape for most efficient cutting. For a given set of conditions of machine, speed and material to be cut, there is one combination of cutting tool rake, side slope and clearance which will give the best results. And yet almost no two so-called practical machinists will agree on what those angles should be. In shops where this subject has not been studied and worked over, tools will be found in service with as many different angles as there are machinists. Some of these are bound to be wasteful in power consumption and time required for the operations, and they also frequently turn out a poor quality of work.

One of the papers read at the Tool Foremen's convention, appearing elsewhere in this issue and freely giving credit for much of the information to F. W. Taylor's book, "The Art of Cutting Metals," proposes a set of standard rake, clearance and side slope angles, which have been used with marked success on several roads, notably the Santa Fe. Tools are ground to these standard angles by means of a set of template gages, which are illustrated in the article and deserve the careful consideration of machine shops and tool foremen throughout the country.

In addition to better work, decreased time and power consumption, secured with these standard cutting tools, they can be made in quantities at reduced manufacturing cost and shipped to various points on each system. They can also be kept on hand at local toolrooms and distributed at regular intervals to machine operators in place of dull tools, thus eliminating idle machine time caused by operators grinding their own tools. It usually proves a real saving to have a boy or special man, assigned to this work, make a round of the machine shop once or twice a day, supplying machine operators with freshly-ground tools in place of those which are dull, the latter being brought back to the toolroom and reground to the standard shape by a grinding machine operator, who becomes rapid and expert on this work.

What Our Readers Think

Modern Motive Power and What Should Be Accomplished in Research Work

Chicago.

To the Editor:

The proceedings of the Mechanical Division of the American Railway Association as given in the July issue have been read with interest. While the committees followed the trend of actual accomplishments of the preceding year, yet it seems necessary for the foremost engineers of the country to get together for the purpose of discussing the designs of modern motive power. We are at a point now where we have reached the limit, and at times have exceeded the limit, of locomotive construction along conventional lines. The simple reciprocating engine has played its part well and will probably be used for a long time to come, but is there anything being done that is a radical departure for the better? Modern electrifications with current generated by water power are rapidly developing with a general outlook for the future but still there is a vast field for modern motive power reconstruction and research. There seems to be a tendency of trying to improve our present standards of power by equipping them with all sorts of appliances which will produce some slight economy—safety devices, labor saving devices, etc., and while it is generally acknowledged that with the applications of such devices there is some gain in the efficiency and economy of a locomotive, yet this is not starting from the fundamental principles of reconstruction. It seems as though the railroads were afraid of modern research, which would end ultimately in enormous savings, smoother running and lighter power.

Today everything is sacrificed to maintain present standards of motive power to haul tonnage. This is desirable as far as our present analysis of operation is concerned. But the future—are we looking far enough ahead in order that modern engineering may benefit the railroads? What we are interested in nowadays is mostly weight on rail, tractive force and tonnage hauled over heavy grades. The larger the locomotive, the better it is liked—until the rails start to give way and the cost of maintenance increases to such an extent that it is finally decided that they are too large economically to be effective.

There is no question that we will have to make some radical changes sooner or later, already some steps are being made in the direction towards lighter power by analyzing the journal bearing situation. Some good results have been obtained in Sweden, England and in this country with roller journal bearings. Other questions to be thoroughly studied are the modern methods of exhaust steam condensation for maximum economy, induced draft, the application of the turbine, the Diesel engine, and the turbo-electric engine. Considering the complicated machinery and the results of the initial trials, there is no question in my mind that results can be obtained if the railroads would put heart and soul into these things and develop a research organization of the highest grade. W. B. Storey, president of the Santa Fe mentioned this in his address before the American Railway Association. There is an evident need for this kind of work. The American Railway Association meeting followed the labor situation very closely, but with the exception of more modern facilities for the handling and repairing of motive power, we are, and will remain in the same predicament in relation to the labor organizations for a long time to come. Good engineering can cut down the cost of labor, and in my opinion is better than experimenting with employee organizations.

Much has to be done in the future and the sooner it is started the quicker will be the benefit to public service and the railroads.

E. GELZER,
Leading Locomotive Designer, Illinois Central.

New Books

PROCEEDINGS OF THE AIR BRAKE ASSOCIATION 1923. *Edited by the secretary, F. M. Nellis, 165 Broadway, New York.* 285 *pages, bound in leather.*

This book contains the proceedings of the Thirtieth Annual Convention of the Air Brake Association which was held in Denver, Colo., May 1, 2 and 3, 1923. The reports submitted cover Expediting Train Movement; Charging Freight Trains; Causes for Slow-Acting Air Compressors; Feed Valve Tests; Relation of Train Control to the Air Brake; Service Records and Maintenance Costs; Standardization of Air Brake Repairs; Laundering Air Compressors, and Maintenance of Air Compressors.

PROCEEDINGS OF THE MASTER BOILER MAKERS' ASSOCIATION 1923. *Edited by the secretary, Harry D. Vought, 26 Cortlandt street, New York.* 120 *pages, 6 in. by 9 in. bound in cloth.*

This book contains the proceedings of the Fourteenth Annual Convention of the Master Boiler Makers' Association which was held in Chicago, May 22 to 25, 1923. The reports submitted included Hammer Testing of Staybolts; Maintaining Combustion Chamber Boilers; Finished Plates; Detecting Defective Boiler Sheets; Automatic Stokers; Method of Applying Flues; Life of Superheater Tubes; Steam Leaks; Recommended Practices, and Care of Stationary Boilers.

FIRE LOSSES—LOCOMOTIVE SPARKS. *By L. W. Wallace,* 203 *pages, 6 in. by 9 in.,* 111 *illustrations, bound in leather. Published by Barr-Erhart Press, New York.*

Comparatively little has been printed on the subject of fire losses from locomotive sparks and means for minimizing such risks. The need of spark arresters, however, was appreciated even during the early development of the steam locomotive. One portion of this book describes their evolution up to the present day. Valuable contributions to the knowledge of spark arresters was obtained from the experiments made at Purdue University in 1902, the results of which were embodied in a book entitled Locomotive Sparks, by W. F. M. Goss, and also from the report to the Railway Master Mechanics' Association in 1906. Since that time a number of laboratory and road tests have been conducted which have furnished considerable new data. This information has been placed in book form and is now available for the first time. Additional material on the subject of spark fire prevention and regulation of railroad fire hazards has been included which will be of interest to those desiring a knowledge of the subject.

THE ELECTRICAL HANDLING OF MATERIALS, VOLUME FOUR, *by H. H. Broughton, Member Institute Mech. Engrs., Member Institute Elec. Engrs., etc., 1923.* 334 *pages, 8⅛ in. 10½ in. Bound in Cloth. Published by Ernest Benn, Ltd., 8 Bowverie St., E. C. 4, London.*

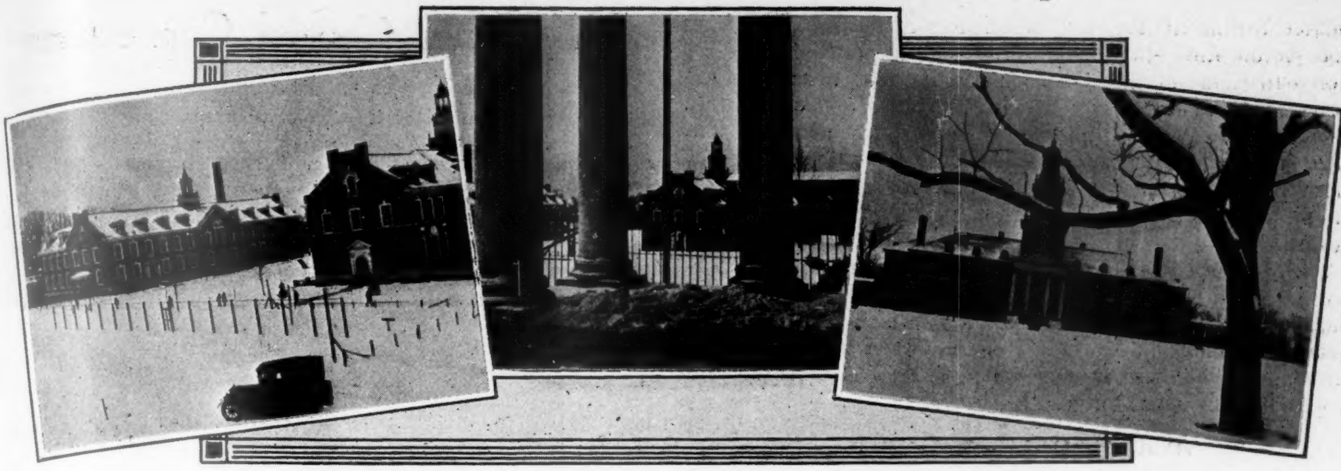
The volume is the final one of four on the design, construction and application of cranes, conveyors, hoists and elevators. The present book concerns itself with machinery and methods. There are 12 chapters in the book which bear the following titles: Elevators and Conveyors, Belt Conveyors, Automatic Feeders, Handling Materials Automatically with Skip Hoists, Lessons from America in Bulk Handling of Materials, Handling and Storing of Grain, Suction System of Discharging Grain, Handling and Storing of Coal, Ore, and Similar Bulk Materials, Handling and Storing of Coal, Ore, and Bulk Materials (continued), Belt Shipping Plants, Panama Coaling Stations and Handling of Foodstuffs and General Merchandise. The above outline is significant of the wealth of material which the book contains. There are 279 illustrations showing in great detail the design and application of the various equipments described. A large number of tables are also included which give specific information concerning the numerous details of the many different kinds of belt conveyors, bucket hoists, elevators, etc.

LAMINATED SPRINGS. *By T. H. Sanders.* 519 *pages, 6 in. by 9 in.,* 282 *illustrations, bound in cloth. Published by the Locomotive Publishing Company, Ltd., London, and Spon & Chamberlain, New York.*

As far as we are aware, this is the only complete treatise on laminated springs which has been published in English. The book is divided into two parts, the first being devoted to the subject of calculation and design and the second to manufacture. In the first half, the subjects taken up include stress and strain, elasticity, deflection, formulas, testing, thickness and lengths of plates, finish of ends, center fastenings, resiliency and weight, periodicity, and methods of making necessary calculations. The second half treats of questions relative to the character of spring steel, analysis, work in the forge shop, fitting and heat treating, banding and finishing, together with illustrations and photographs of machinery and other equipment used in spring manufacture. The book is thoroughly illustrated both by drawings and photographs, and contains a very complete index. While the treatment of the subject matter is somewhat more inclusive of British practices, considerable space is also given to American and European practices and equipment. The book should prove of material value to those responsible for the design of elliptic and semi-elliptic springs used on locomotives, passenger cars and automobiles, as well as to the shop man having oversight of the manufacture of such springs.

KENT'S MECHANICAL ENGINEERS' HANDBOOK. *Robert T. Kent, editor-in-chief. Tenth edition;* 2,247 *pages, 4¼ in. by 7 in., illustrated. Bound in morocco. Published by John Wiley & Sons, Inc., New York.*

Kent's handbook needs no introduction to the engineering public, particularly in the mechanical field. Since the first edition was published in 1895 and throughout the succeeding eight editions, it has been widely used as a practical reference book of engineering data. These editions have largely been revisions of the material in the first edition, with the addition of new material from time to time as the scope of the mechanical engineering field changed and broadened. The result has been the gradual development of a lack of balance of the material in the book, some divisions of the science which 28 years ago held first rank now being of relatively minor importance while other divisions have taken their place. In the present edition the book has been completely rewritten by a large corps of contributors each chosen for his fitness to select and prepare the material for one of the sections. The editor-in-chief is the son of the late William Kent, the founder, and he has followed the latter's fundamental ideas that this be a book of engineering practice rather than engineering theory. Among the new subjects appearing for the first time in this edition are Aeronautics, Automobiles, Heat Insulation, Reinforced Concrete, and Safety Engineering and Machine Design. Many other sections have been rewritten so as to be practically new. The book contains over 50 per cent more matter than the previous edition. It has been carefully edited to insure the greatest practical convenience in the user.



Left: Electrical and Mechanical Engineering Building and Part of Civil Engineering Building, Johns Hopkins University. Center: Same Buildings from Gilman Hall Portico. Right: Gilman Hall and Quadrangle

Opportunities for College Graduates

Also Suggestions as to How Railroads Can Make the Best Use of These Men

By Alfred H. Burnham, Jr.*
Special Apprentice, Baltimore & Ohio, Mt. Clare Shops, Baltimore, Md.

THE college graduate has had roughly 16 years of schooling. Taking the average of the class and leaving out the two extremes, *i.e.*, the loafer who just skins through, and the leader of the class scholastically, one finds a boy who is a worker and who is ambitious. During these 16 years he has been busy acquiring knowledge from books, and he has missed the thing that the boy who quits school early in life has obtained—rubbing elbows with the wage earning world.

Opportunities

Three opportunities present themselves to the college graduate who enters railroad service:

First, the opportunity of rubbing elbows with industry.

Second, the opportunity of studying labor as a class and human nature individually.

Third, the opportunity of studying industrial organization.

Alfred H. Burnham, Jr.

The first is important because it is necessary that he take stock of himself. He soon learns that pluck and grim determination are two of the best assets he must have to win success in the railroad field, with its vast number of employees and the hard work attached to it.

It is vital for him to recognize the second of these opportunities, because in any field, and particularly the railroad field, a thorough understanding of the attitude of labor as a class, and his individual attitude is necessary. My point is this: He has set before him a goal which means that sooner or later he will be in some position as one of the executives of the road. He will be a failure in that position if he does not have the ability, from his study of human nature, to get co-operation from those under him down to the last man. Co-operation will bring results. The opportunity to do this is always present, whether in normal times, or when labor is stirred with strikes and unrest.

Assume that he avails himself in every way of the second opportunity, he will not make much headway, if he overlooks the third opportunity; *i.e.*, that of studying the organization of which he is one little member. Most probably he finds himself in one of the repair shops of the road, and his opportunity to study and learn the shop methods and the whole system of shop management is always present. After knowing the existing methods, he will be able to see and make good suggestions for improvements. His study is made much easier under an organized apprentice system, due to the fact that he moves in regular sequence through all the shops and departments.

A college apprentice, or, in fact, any apprentice, has

*Graduate of Johns Hopkins, School of Engineering, Class of 1922.

offered to him all the past experiences of the men who have gone before him—this in the form of an apprentice organization with some of these men behind it. Based on their experience, these men plan for him schedules and assign him to places where they think he will get the most necessary and most important information appertaining to the work of the mechanical department. If experience of others counts for anything to an apprentice, then this is certainly a *real* opportunity.

An apprentice under such a system has unlimited opportunities for advancing himself, his ability developing with time and with what he puts into his studies. Furthermore, such plans make the earnest apprentice feel a responsibility always to do his best, in view of the effort that is behind him to give him an opportunity to learn.

What the Railroads Can Do

How can the railroads best use the college boy apprentice? Looking back again to this boy in school, it is discovered that during the 16 years he has acquired the habit of thinking out problems for himself. This asset he brings with him to the railroad. After a reasonable period has gone by in which his "stick-to-it-tiveness" has been tested (for some weaken and quit because the road seems too hard and too long), give him a job that will require him to do some of this thinking to which he has been accustomed. In the first place it will keep him more interested in his work, and, second, it makes him feel like a part of the organization. Not that he has not been thinking. He has. But give him a job that will make him feel that some one higher up is holding him responsible for something that he must work out himself.

To illustrate: The test department of a certain railroad was running tests on a number of rebuilt Consolidation locomotives. It so happened that that department was very busy and no men were available to work up the data which were accumulating from the dynamometer car. The head of the department sent to the shops and obtained two special apprentices who had been there quite some time. He gave them instructions and explained the method for submitting the reports and data, and the rest was up to them. The result was that the men were pleased and contented with their work. In addition to this, they acquired considerable information as to the respective merits of the old and the new class of locomotives. They also felt, through their conferences with the department head, that they were a part of the organization.

Here is another instance in which the results were just as favorable: The shop order bureau wanted an investigation of production in the forge shop. A special apprentice was detailed to do the job. He was greatly pleased with the opportunity of learning something about the forge shop production methods.

The answer, therefore, to the question of how the railroads can best use the college boy apprentice is to give him the job that is a little different and requires a touch of his own personality. He will try hard, he will give his best, and will be a most loyal employee. He has been trained to do so.

[This article received honorable mention in the Special Apprentice competition. For the prize winners, see the editorial on page 674.—Editor.]

The new type of condensing locomotive designed by David M. Ramsay, a Scottish engineer, has attained a speed of 60 miles per hour over short runs and pulling heavy loads, according to the Times (London). The steam is generated at a boiler pressure of 200 lb. per sq. in. and superheated 300 deg. F. It is then passed through a turbine and on to the condenser, whence it is pumped back as water into the boiler, so completing the cycle. A second engine of the kind is to be constructed.

Oil Burner Control Connections

By E. P. Hill

Central of Georgia, Savannah, Ga.

On oil-burning locomotives a number of levers, rods and joints are required in the connecting mechanism between the fire control handle in the cab and the valve which supplies the oil to the burner located in front of the firebox. To insure accurate control of the oil supply, lost motion in these connections must be kept at a minimum and this adds

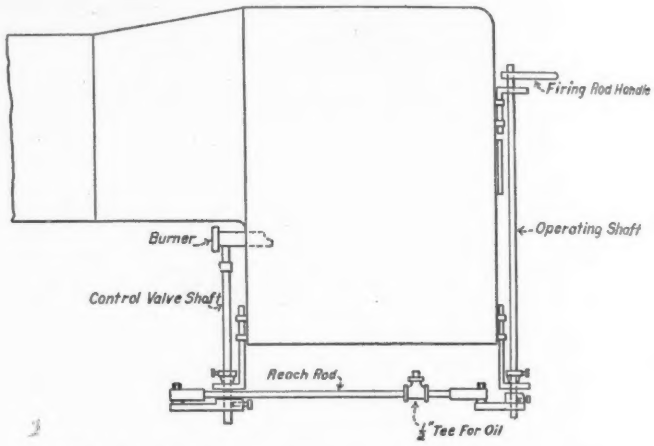


Fig. 1—General Arrangement of Oil Burner Control

to the cost of maintenance and to the attention required at terminals. An arrangement which has been in successful operation for a number of years with practically no expense for maintenance and adjustment is shown in the accompanying illustrations.

The essential feature of this control mechanism is the use of lubricated taper connections, which take care of such lost motion as may develop from constant use. As will be noted, taper bushings (held by set screws) are used on the operat-

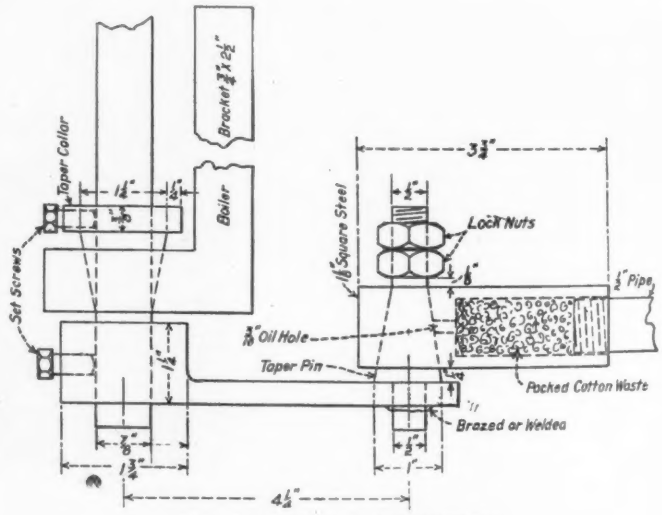


Fig. 2—Details of Construction

ing and control valve shafts and taper pins are used to connect the reach rod to the arms on the two shafts. The reach rod is of ½-in. extra heavy pipe with ends made from 1⅛-in. square steel. These ends are hollow and packed with cotton waste. A tee, located at a convenient point in the reach rod, is used for filling it with oil. The employment of waste prevents the oil passing with too great rapidity to the 3/16-in. holes leading to the pin bearings and still supplies enough

for ample lubrication. A single filling of the reach rod with a half pint of engine oil is sufficient to last three months. The taper pins have a clearance of from ¼ in. to ⅜ in. between the reach rod end and the lever arm and from ⅛ in. to 3/16 in. clearance between the nut and the top of the end header, which permits of free operation.

American Locomotive a Success in France*

Two-Cylinder Superheater Simples of Pacific Type More Efficient Than French Compounds on Paris-Orleans Railway

By M. Lunier

Inspector of Equipment, Paris-Orleans Railway

THE Paris-Orleans railway in 1921 placed in service 50 Pacific type locomotives with simple cylinders and equipped with superheater. The purchase of these locomotives, which had been deferred until after the summer season of 1920, was decided upon at that time to meet the resumption of express service beginning with the summer of 1921. Because of the quick delivery required, the order was entrusted to the American Locomotive Sales Corporation.

The design was worked up by the engineers of the American Locomotive Company with the collaboration of representatives of the Paris-Orleans railway, with the object of introducing in the American type the detail arrangements which are standard on the Paris-Orleans line and necessary in view of the operation as organized on this line.

The locomotives, No. 3591 to No. 3640, are of the Pacific type, with 76¾ in. driving wheels, 38¼ in. leading truck wheels and 48¾ in. trailing truck wheels. They are simple expansion with two outside cylinders and use superheated steam.

The boiler is of the straight-top type with entire firebox of steel plate. The staybolts are of iron and drilled at the two extremities with a ¼ in. hole. The firebox crown is radial and is supported by radial stays, having a ¼ in. hole through their entire length. Flexible staybolts to the number of 515 are applied on the four sides of the firebox, located in the zones where breakage ordinarily occurs. The three front rows of crown stays are flexible.

The fire door is in three sections and opens upward toward the interior of the firebox. This door has been applied since 1907 on powerful locomotives with large grate area on this road. The rectangular grate is of the rocking type, formed of four sections.

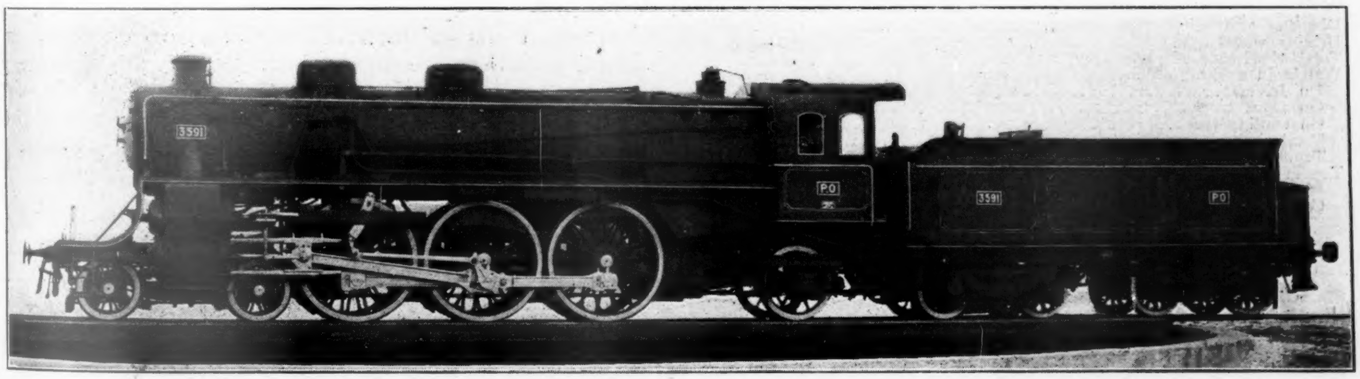
The safety valves are two in number, 4½ in. in diameter, and of the Coale type. The water is fed to the boiler by two vertical Nathan No. 10 automatic restarting simple non-lifting injectors. The water enters the boiler at the top near the front tube sheet, the delivery pipes ending in the steam above plates with tooth edges. The water gage is of the Klinger type with valves which can be operated at a distance.

The throttle is a balanced valve placed in the dome. Under the throttle a water separator is installed, the function of which is to throw back into the boiler before its entrance into the throttle the water which might be carried up in the steam.

The variable exhaust nozzle is of the Nord type. The smokebox is supplied with a basket netting in two parts held by keys, which permit it to be taken down rapidly. The superheater is of the type furnished by the Superheater Company. The damper has been omitted, as has been done for several years on all superheated engines on this road.

The frames are of the American bar type. In the manner of supporting the boiler, spring suspension and equalization as well as in the design of leading and trailing truck American practices also are followed.

The cylinders are furnished with a by-pass valve operated by a steam cylinder for running with closed throttle. They also are provided with vacuum valves placed on the steam chests and with relief valves attached to the cylinder heads. The piston valves are of the type used on the Chemin de Fer de l'Est and have inside admission. The piston rod and valve stem packing is of the Sullivan type. The cylinders are lubricated by a Detroit five-feed hydrostatic lubricator; two feeds go to the steam pipes a little above the steam chest,



Fifty American Built Locomotives of This Design Are in Service on the Paris-Orleans Railway

* Translated and abstracted from an article in the July, 1923 issue of the French publication Revue Générale des Chemins de Fer et des Tramways.

two others go directly to the cylinders. The fifth feed takes care of the lubrication of the air compressor. The valve motion is the Walschaert type, with a screw reverse gear.

The pistons have three rings and are screwed onto the piston rods. They have a piston rod extension, with guide, of the Coale type. The crossheads, of the alligator type, are of cast steel. The heads of the main and side rods are of the European type with solid ends and are equipped with an adjusting wedge for taking up the wear.

A cylinder brake is employed and, to permit running against steam pressure, the locomotives are equipped with two valves—one for the admission of steam into the exhaust passages of the cylinders, the other for the admission of water into the steam chests. The automatic air brake is of the Westinghouse type, operating on all the wheels with the exception of those on the trailing truck. The braking effort is 65 per cent of the weight on the rails for the driving wheels and only 40 per cent for the engine truck wheels. The straight air brake operates only on the locomotive and tender.

The locomotives are equipped with the following apparatus and specialties: A Hausshalter speed indicator and recorder; a Lambert sander, which sands in front of the second pair of drivers, and a hand sander to sand in front of the first pair of drivers; a steam heat apparatus with Mason reducing valves and flexible connections of the Westinghouse type, also a cleaning valve for the smokebox and one for the ash pan.

The accompanying table gives the principal characteristics of the locomotives and tenders.

Principal Characteristics of Locomotive

Boiler pressure	171 lb.
Grate area	50.6 sq. ft.
Heating surface, firebox	154 sq. ft.
Heating surface, tubes	2,248 sq. ft.
Total heating surface	2,402 sq. ft.
Superheating surface	775 sq. ft.
Ratio total heating surface + grate area	47.5
Length of tubes between sheets	19 ft. 10½ in.
Tubes, number and diameter	165—2 in.
Flues, number and diameter	26—5⅜ in.
Cylinders	24.4 in. by 25.6 in.
Diameter of driving wheels	76¾ in.
Diameter of engine truck wheels	38¼ in.
Diameter of trailing truck wheels	48¾ in.
Driving wheel base	13 ft. 4 in.
Total wheel base of engine	36 ft. 7 11/16 in.
Weight in working order—	
On drivers	116,500 lb.
On front truck	47,500 lb.
On trailing truck	37,000 lb.
Total engine	201,000 lb.
Tender	120,600 lb.
Tender—	
Water capacity	5,812 gal.
Coal capacity	6.6 tons

The stability has been perfect at speeds which have reached 77½ m. p. h. and on runs of 62 m. p. h. average speed. This average speed has been reached at different times without experiencing a "nosing" or vibration any greater than that which is observed on the four-cylinder compound locomotives.

One of the most interesting peculiarities of these Pacifics is the reduction of frictional resistance which they show in relation to compound locomotives. The chart, Fig. 5,* gives a clear idea of this and shows conclusively the superiority in this respect of the two-cylinder superheater machine over the four-cylinder machine.

In regular service, these machines give the best of results. Their fuel consumption is slightly lower than that of the compound machines used in the same service, as is shown in the following table, which gives the fuel consumption in regular service recorded for compound superheater Pacifics and for the simple expansion superheater Pacifics described. The locomotives chosen for this comparison were in the same state of good repair and had made from the time of coming out of the shop to the beginning of these records, practically the same mileage (25,000 miles). They were in the same service and driven by crews of equal skill. Neither one of the two types was equipped with feedwater heater.

Locomotive number	Type	Kilometers run	Metric ton km. engine and train	Fuel consumption kg.	Average consumption per 100 ton km. kg.
3,537	Compound	7,809	4,118,439	112,450	2.73
3,539	Compound	7,588	4,094,268	112,740	2.75
Average for the compound locomotives					2.74
3,632	Simple	7,939	4,377,974	108,130	2.47
3,629	Simple	7,694	4,001,415	110,070	2.75
3,638	Simple	8,436	4,515,289	112,070	2.48
3,636	Simple	7,981	4,157,723	100,990	2.43
Average for the simple locomotives					2.53

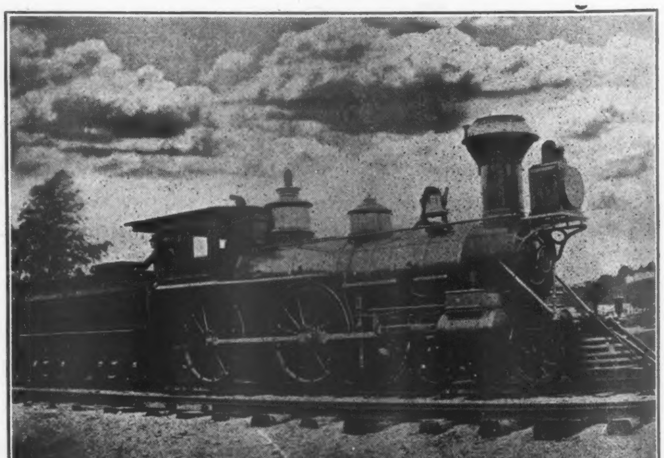
The allotment of fuel to the enginemen for the two-cylinder locomotives is 5.26 per cent less than that for the four-cylinder compound superheated locomotives.

It should be noted that these locomotives, in which the superheating surface is 775 sq. ft. against 684 sq. ft. for the four-cylinder compound locomotives with which they are compared, operate in general with a temperature of superheater steam at the admission to the cylinders higher than that which can be obtained with the compound.

During the comparative tests made in July and August, 1921, the average temperature of the superheated steam was 642 deg. F. on the simple locomotive and only 556 deg. F. on the compound locomotive for identical trains. This temperature was measured by means of a Fournier pyrometer of the most recent type, having in place of the old cylindrical reservoir with a protecting bushing, a reservoir formed of a helical tube plunged directly into the current of steam.

These locomotives require very little maintenance and are greatly appreciated on this account by the engine drivers and master mechanics.

These tests confirm the results obtained by American railroads with two-cylinder Pacific locomotives. This type promises excellent service on French roads. These locomotives are simpler and have a smaller resistance to movement than the four-cylinder compound locomotives. Their maintenance is easier. As to their fuel consumption, it has been less but it may be that they owe this superiority to their higher superheat. At an equal superheat, it would seem that the consumption of these two types of machines would be substantially equal, the theoretical advantage which their better expansion gives to the compounds, being overcome by the increase in resistance caused by the four cylinders.



Published by Courtesy of the Railway and Locomotive Historical Society.

B. & M. Locomotive "Saxon" Equipped with Magoon Feedwater Heater Operated from Crosshead. Used Between Boston and Exeter About 1874

*Chart, not reproduced, shows an increased resistance for the compound locomotive ranging from 20 per cent at low speeds to 13 per cent at high speeds.

Traveling Engineers Hold Live Meeting

Convention at Chicago Emphasizes Economies in Long Engine Runs and Feed Water Heaters

TWO of the subjects which received most attention at the thirty-first annual convention of the Traveling Engineers' Association, held at the Hotel Sherman, Chicago, September 11 to 14, inclusive, were the economies possible by extended locomotive runs and the extended use of feed water heaters. The program was broad, however, and other subjects of vital interest to traveling engineers and highly essential to the efficient handling of railroad motive power were discussed at length. The convention was featured by addresses by Frederick Kerby (B. & O.), president of the association; G. M. Basford, Lima Locomotive Company, and J. W. Scott (B. & O.), general superintendent, West Virginia district.

Election of Officers

In accordance with the usual custom the officers of the Traveling Engineers' Association were advanced, the officers elected for 1924 being as follows: President, T. F. Howley (Erie); first vice-president, W. J. Fee (Grand Trunk); second vice-president, J. N. Clark (Southern Pacific); third vice-president, J. B. Hurley (Wabash); fourth vice-president, J. D. Heyburn (Frisco); fifth vice-president, James Fahey (N. C. & St. L.); treasurer, David Meadows (Michigan Central). Four members of the executive committee were retained, J. C. Simino (Southern Pacific) being elected to take the place of James Fahey, who was made fifth vice-president.

President Kerby's Address

In his opening address President Kerby spoke in part as follows:

One year ago today all of our railroads were in the midst of one of the largest strikes in their history. During the strike the motive power and rolling stock reached the worst condition we have known for some time, just when the country was most in need of good equipment to handle its heavy business. But the roads have now recovered and have handled the largest business in their history. This was brought about by peace and the co-operation of all interested as well as by the energetic and economical management of the officers, in which the members of this association deserve some of the credit for the part they have taken.

The railroads loaded more than four million freight cars in both May and June of this year, the heaviest traffic ever carried by American railroads in a similar period. Despite the record-breaking movement, the number of freight cars in good repair and immediately available for use continued to increase, so that on July 31 a surplus of 76,453 serviceable freight cars was recorded. Team work and co-operation among the railroads and the shippers, and among the men within the various organizations, brought this about.

To meet the heaviest transportation demands in the history of America, the railroads fixed high standards of operation efficiency: First, 85 per cent of the locomotives in serviceable condition by October 1; second, 95 per cent of the freight cars in serviceable condition by October 1; third, 30 tons of freight as the average car load; fourth, 30 miles per day as the average car movement. In progressing toward this goal, the railroads as a whole increased the number of serviceable locomotives from 75.9 per cent on January 1, 1923, to 83.8 per cent on July 1, with three months more to make the other 1.2 per cent, which they will do. They increased the number of freight cars in serviceable condition from 90.5 per cent on January 1, 1923, to 91.6 per cent on July 1, with 3.4 per cent to make in three months, which they will do. The heavy loading of cars for all of the railroads increased from 27.8 tons in April to 28 tons in May, the last month for which complete data is available. The railroads increased the average daily movement of freight cars from 27.3 miles in April to 29.6 miles in May, as compared with 22.7 miles in May, 1922. With the additional new locomotives and new cars that are now ordered and will be delivered by October 1, the roads are in better condition to handle the increased traffic than ever before. We are a prime factor in accomplishing this work, and that is one of the reasons for our being here today.

Any railroad officer who does not feel that there is sufficient benefit derived from these conventions to send his men is not properly informed in the reports that you give him on your return from the meetings. Efficiency in railroad

Frederick Kerby (B. & O.)
President

T. F. Howley (Erie)
First Vice-President

W. J. Fee (Grand Trunk)
Second Vice-President

work is a matter of education and experience and is mostly obtained through association with others.

Address by G. M. Basford

Wednesday afternoon the association was addressed by G. M. Basford, who suggested that the new operating conditions required by the highly developed modern locomotive present a great opportunity for the association. Speaking in part as follows, Mr. Basford gave his opinion of the direction in which this opportunity would be found:

"In its history of 31 years of consistent constructive work this association has been perfectly preparing for one of the greatest services that can be rendered to the railroads. During the latter half of this period the creators and builders of locomotives have transformed them from crudity into an advanced state of perfected development. With respect to efficiency today they are fully prepared for comparison with power plants of equal capacity—either stationary or marine. What stationary or marine power plants of 3,000 to 4,500 hp. capacity can operate at the rate of 1.83 lb. of coal per hp. hour? You have contributed to this progress and you more than any other agency can render the progress most effective in performance.

"You are highly regarded not only as an organization but as vitally necessary railroad officers and as individuals. You are operating men no matter to whom you report. You have the advantage of a knowledge of the locomotive itself, of its handling and also of railroad operation. Strictly operating officers are handicapped by lack of time to know what you know of the machine. Strictly mechanical men lack the opportunity to know what you know of railroad operation. Moreover, you have the opportunity for intimate contact with operating officers to interpret to them the meaning of the improved power plant that is in their hands.

"There is much the locomotive is ready to do to increase the capacity of a line and to reduce the cost of moving tons, but other things are involved to prepare its way. Many important operating improvements have already started and are working wonderfully well. They need your active assistance and continuous support. Let us glance at a few of them.

"Operation of one track of a double track line in the reverse direction saves many idle hours for equipment and for men. Scheduling freights, watchful tonnage rating, determination of most economical speeds, the 'turn around' plan, operation of traffic by signals without train orders, the substitution of '19' orders for '31' orders, 'main trackers,' long locomotive runs, machine handling of outlying siding switches, application of train control without limiting capacity of track and of equipment—all these are matters wherein your influence and help are needed.

"Think of a 'main tracker' saving an hour in every 88 miles or 12.5 hours in 1,100 miles. Think of 53 per cent increases in locomotive mileage by increasing the length of runs. Locomotives have been designed and built for short runs. They will be designed and built for long ones. Your influence in this will be very great.

"You have remarkable power over the question of locomotive terminals and their equipment, coal and ash facilities, the washing of boilers, the firing up of engines and the all-important boiler water question. Your printed records are filled with accomplishments mainly on the mechanical side of these questions. It now remains to reveal that everything you do is really an operating and not a mechanical function.

"It is an impressive fact that with all its increased complication to provide its increased power the physical task of running a locomotive is easier than it ever was. But how about the handling to get the necessary work from the new locomotive? As the locomotive began to approach the stage of efficiency of stationary power plants with turbines and condensers, as it began to increase its power per pound of metal and per pound of fuel, the difference in performance because of difference in handling on the road became greater. This presents an ever new problem in the education and training of the men who fire and who run the locomotives of today and those will run the locomotives of the future.

"It is most important that the new locomotive power plant should not be hampered in its earning capacity by limitations that are a legacy from the days of light power. No one else can do as much to make the locomotives of today and those that are to come earn what they should earn as the traveling engineer."

Economy of Long Runs

The committee received answers to questionnaires from numerous roads. The information gathered from the questionnaires will be referred to throughout the discussion.

In the following table the term "Past Practices" refers to the operation of locomotives in both passenger and freight service over one operating division, the operating mileage varying with the length of the division. By the term "Present Practice" the committee refers to the mileage that is now being regularly operated in freight or passenger service, many roads reporting the extension of runs to more than one division, though it seems that the extension of runs in freight service has not gone as far as the extension in passenger service.

Mileage of Locomotive Runs in Passenger Service

Roads	Past practice	Present practice	Increased mileage
A	144–187	331	187–144
B	101–175	175	174–100
C	173	375	202
D	161	289	128
E	100–183	234–300	134–117
F	303	603	300

On the M. K. & T. runs of 678 miles, on the Union Pacific, 484 miles to 564 miles, and on the Burlington 483 miles, stand out as examples of high mileage which can be made per run with passenger locomotives. Sixteen roads reported substantial increases in the mileage per locomotive run, in most cases this increase amounting to double the former practice. The questionnaire was only sent to 18 roads concerning which the practice of extending locomotive runs had been given more or less publicity.

Decrease in Number of Locomotives

While at many points it has been found possible to increase the mileage of individual runs by 100 per cent, it has not always followed that the average miles per locomotive in the group considered would amount to 100 per cent, though the average mileage per period of time has shown substantial increases, ranging from 30 per cent to 100 per cent. At several places the same service is being maintained with one-half the power which was formerly required. In the answers to the questionnaires, one road reported five engines now covering the service formerly requiring nine engines; on another road two engines are used as against four engines; on another five engines are used as against six; on another 26 engines are used as against 52; another shows 38 as against 40; another shows six engines as against 11, while another shows 47 as against 54 engines.

From the reports it is evident that the cost of handling power per dispatchment varies largely in different parts of the country. At one large eastern terminal the present cost of dispatchment is in the vicinity of $12 and the present mode of operation reduces the dispatchments from that point by 28 per day; in other words, it can be claimed that there is a direct saving at this point of $336 a day, which amounts to approximately $10,000 per month resulting from running the engines over two divisions. It is proper to claim the present cost per dispatchment when multiplied by the number of dispatchments saved, as a saving to be credited to the extension of locomotive runs.

The cost per individual dispatchment resulting from this change seems to have decreased materially at many points. This decrease seems to result from the more efficient handling of the particular terminal, due probably to reducing its capacity to normal. One example of this increase in efficiency at the terminal is shown by the reduction in cost per locomotive dispatched from $8.39 to $4.20, another reduction from $12.99 to $11.72, another from $16.60 to $12.70, and another from $14.03 to $9.89.

Increasing Railroad Capacity

At one of the eastern terminals where passenger facilities are overcrowded, it is noted that by running engines through this terminal there are saved for each eastbound engine operated three movements per engine through an interlocking plant, four movements for each westbound engine through a second interlocking plant, two movements per engine over a draw-bridge, and in fact this particular terminal was so crowded at times that it was almost impossible to find storage room for locomotives while awaiting trains when power was changed at this point. Running the locomotives through this terminal avoided the necessity of having to find this storage room. At another point on the New York Central where freight and passenger business was handled through the same terminal considerable reduction in terminal delays to freight trains has been avoided by running passenger engines through this terminal.

Practice Required by Longer Runs

The reports from questionnaires indicate that in places it is necessary to fill grease cups at intermediate terminals, at other points it is necessary to shovel coal ahead, while some of the roads report that coal passers on the engines are making this unnecessary. No attention is given to the fire, other than a program of education for the fireman. A similar educational program is required for the engineman in regard to inspection and oiling. Several railroads report that a stop is made for additional coal enroute.

It has been found advisable on most roads undertaking the extension of runs to begin with a few runs and gradually increase the number until all the runs available are so operated. On the New York Central it was found necessary to instruct enginemen to watch both cylinder and journal lubrication more closely than had formerly been necessary. Enginemen were instructed to report personally to the relieving engineman relative to locomotive conditions as observed during his run, and at the final terminal the report was made to include all items observed by all enginemen operating the engine since leaving the initial terminal. It was also found necessary to follow these reports closely to insure that the enginemen were giving them proper attention.

The most difficult matter in the education of the fireman was with respect to the sort of fire to be brought into the terminal at which he is relieved. This instruction plan changed his manner of firing to insure as nearly as possible at all times a clean fire, with some grades of coal requiring a slight shaking of the grates possibly twice on the division, while with other grades of coal a slight shaking of the grates possibly three or four times.

The reports from the extension of runs on the New York Central indicate that at the start when the first few trains were operated and the supervision was very close, the engine failures were reduced very materially, and at the present time when all trains which can be handled are so operated, the engine failures apparently are not affected by the mileage which the locomotive makes. Analysis of a large number of these locomotive failures show that the majority take place on the first division over which the locomotive operates. The analyses further prove that the mileages of the individual runs have little or no effect upon the number of engine failures accumulated.

Effect on Schedules

From the replies to the questionnaire it is evident that locomotive terminal time has been slightly increased. The time allowance at terminals, for instance, on one road increased from 6 hr. 55 min. to 8 hr. 29 min.; another road reports an increase from 7 hr. 30 min. to 10 hr. 8 min.; another road reports at one end of the run terminal time of 6 hr. 40 min, and at the other end of the run terminal time of 15 hr. 45 min. One road reports an average terminal time of 6 hr., this including only running repairs; another road reports terminal time of 12 hr.; another from 7 to 9 hr, while another road reports a short turn-around of 3 hr. and long turn-around from 10 to 12 hr.

The effect on passenger train schedules is nil. It has been found that the terminal time allowed through passenger trains is practically sufficient to do whatever work has been found necessary on the engine, and in a great many cases this work is completed in a shorter time than would have been required to change engines.

J. N. Clark (So. Pac.)
Third Vice-President

J. B. Hurley (Wabash)
Fourth Vice-President

W. O. Thompson (N. Y. C.)
Secretary

Terminal Savings

The importance of the saving in coal which results from increasing locomotive runs over two or more divisions should be given consideration. A large quantity of coal is lost in the operation of cleaning the locomotive fire and more coal is necessary in the re-building of the fire. This is estimated to be from one to two tons per engine dispatched, and with coal costing from $3.50 to $5.00 per ton, it is an item of importance in the reduction of expenses.

Another item of terminal saving is the cost of deadhead-

ing the engine between passenger or freight terminal and the roundhouse. Many roundhouses are located at considerable distances from the terminal and it is necessary to make a mileage allowance for the crews moving these engines back and forth. At one of the eastern terminals this amounts to 56 cents per dispatchment.

In answer to the questionnaire, the saving in operating expense on one road amounts to 49 per cent; on another a saving of $5.33 per dispatchment with one-half the dispatchments formerly made in operation, and coupled with this a saving of one-half the locomotives and of one-fifth of the fuel consumption when expressed on a unit basis. Another road reports an estimate of $9,500 per month saving in passenger service and $3,500 per month in freight service. Another road reports a saving of crew expenses of $503 and engine house expenses of $13,962 per month. Another road reports a saving in operating expenses of $8,943. Another road reports a saving of $2,418 per month, while another road reports a saving of $10,000 per month.

Difficulties of Increasing Locomotive Runs

No information was obtainable from questionnaires as to the difficulties experienced from increasing the mileage per locomotive run, possibly due to the fact that the difficulties had been overcome.

On the New York Central the one difficulty which has given the most trouble has been the water. By close supervision and test observations, this difficulty was overcome and very little trouble is now experienced.

Water and the education of enginemen and firemen, and the question of coal and lubrication represent the total of the difficulties which have been experienced with this new method of operation. The matter of assigned engines to trains is a difficulty present at all times and is probably slightly enlarged by lengthening runs of locomotives. On the New York Central it has been found necessary to supervise the power assignments rather closely in order to insure an assigned engine on a regular train.

The report is signed by W. L. Robinson (B. & O.), Chairman, Edward R. Boa (N. Y. C.), Wm. Daze (A T. & S. F.), D. J Bergin (Wabash), and J. A. Cooper (Erie).

Discussion

In answer to a question the chairman of the committee stated that savings reported in the paper were clear savings and not obtained at one terminal at the expense of another. The importance of good water, good fuel and the co-operation of the crews in getting maximum results from long locomotive runs was emphasized. In one instance six crews handle three locomotives over a 400-mile division, each crew always operating the same locomotive and thus obviating the disadvantages of pooling. The chairman emphasized the fact that long locomotive runs do not necessarily imply pooling of locomotives. Several members maintained that the operation of locomotives over two or more divisions is not a panacea for all ills, but must be governed by local conditions. Some other points of interest were developed as follows: (1) It is not best to pass terminals with repair facilities and allow locomotives to lay over at small points where necessary repairs cannot be made. (2) Without careful planning, lay-overs will frequently absorb additional mileage gained by long runs. (3) Locomotives operating successfully over divisions with low ruling grades frequently cannot be used on extended runs over the next division because of a high ruling grade. (4) Intermediate fuel and water facilities must be considered; also the mileage obtained between shoppings. These factors must all be considered before lengthening locomotive runs with the expectation of marked operating economies. The favorable influence of the Superior flue blower in facilitating long locomotive runs was testified to by several members. In general, the advantages of long runs as pointed out in the paper were admitted by members of the association, who feel that this practice will be greatly extended in the future.

Work of the Traveling Engineer

In considering the questions, "How can the work of the traveling engineer be made more effective? and, Can the usual number of traveling engineers properly take care of the duties expected of them?" the members of the committee realize that this is a subject of importance and that their task is not a light one. We know of no position of which there is a greater difference of opinion than regarding the qualifications and duties of the traveling engineer. A traveling engineer's knowledge of his work and duties is a big asset towards making his work effective—still we do not believe he must be a past master in all that pertains to a locomotive. His personality and the way he deals with the men under his direct supervision, also with the officers and associates in his work, has a material effect on results obtained. He should be a man whose name carries weight with both officers and men, one having the courage of his convictions to say "Yes" or "No" as the case may require, not given to seeking for petty things to criticize, yet not allowing careless and indifferent work or violation of rules to go unnoticed. He should cultivate the faculty of seeing both sides to every question, controlling his temper and getting along with all kinds of men, remembering that much of his success lies within himself. He should shun "gum shoeing" as there is nothing that will more quickly cause his men to lose confidence in him and consequently lessen the results of his endeavor.

The position of traveling engineer is what the name implies; that is, one who travels or puts in the major portion of his time riding on the engines with the engineers and firemen, it being understood that his training has been such that he is a competent critic of the condition of an engine and the work of the engineer and fireman.

By frequently riding on the engines he can keep in such close touch with his power that defective conditions which cause fuel losses and are detrimental to good locomotive operation can be detected and handled for correction before they become serious. Also, when he has young and inexperienced engineers and firemen he is in the right place to learn how they are doing their work and put them right when such is necessary.

The traveling engineer should use his best ingenuity to instill a spirit of honest endeavor in the enginemen so they will use the engines, fuel, tools and supplies in their care as though they purchased them themselves. The success or failure of the traveling engineer's efforts depend very much not only upon his own mental attitude, but upon that of his enginemen and upon the support he gets from his master mechanic as well as the co-operation of the roundhouse foreman. If his superiors have him doing part of every man's work, from the call boy to the superintendent, and holding investigations of all delays, staying in terminals in order to instruct flue-borers, etc., he cannot do justice to his work. He will not have time to ride each engine on his division at least a short distance every 30 or 40 days, nor to instruct such of his enginemen as need close supervision.

From the foregoing we do not want to be understood as advocating that the traveling engineer should put in all of his time on the road and none at the shops, roundhouses or terminals, and assisting at investigations. When an engine fails for steam or fails to make the time and handle the tonnage, and the engine is not found to be defective—when handling calls for an investigation and where damage is done on account of rough handling and in case of emergency, he should hold or attend investigations, as his knowledge

gained by long experience and service in the transportation department is of importance and value to the superintendent in many questions involving transportation. The same thing applies to the master mechanic, who should consider the traveling engineer his trusted assistant, and one to be consulted in many things connected with the successful upkeep and handling of engines. He should see that the recommendations of the traveling engineer are given due consideration and that the reported defects are corrected. If the traveling engineer is allowed to follow up his work and is given the authority which the position deserves, his services will be most effective. Otherwise the usual number of traveling engineers cannot properly take care of the duties expected of them.

The report was signed by J. D. Heyburn (St. L.-S. F.), chairman; J. J. Rossiter (N. Y., C. & St. L.), J. T. Sullivan (B. R. & P.), B. J. Feeny (I. C.), W. E. Preston (Sou.).

Discussion

Emphasis was placed by a number of the members who took part in the discussion on personality as the most important factor in the success of the traveling engineer. He must inspire a degree of loyalty and support such that the crews will do as well or even better by themselves as they do when the traveling engineer is with them, or his work will be a failure. The importance of this quality in dealing with shop forces was also referred to. Observation has shown that the road foreman who inspires a spirit of co-operation in the enginehouse foreman by fairness and direct dealing succeeds in getting attention to mechanical conditions which he wants corrected, with less delay and friction than the one who relies on reports through official channels. The need for improvement in the character of work reports was also touched on, having become so unreliable under the pooling system, that they are a source of unnecessary expense to the railroads. This condition, it was pointed out, is one which should be corrected by the traveling engineer. Because of the impossibility of giving close attention to all locomotives and crews under his supervision, several speakers emphasized the importance of some reports showing the condition of all locomotives and the performance of the crews as a guide to the traveling engineer in concentrating his attention.

Universal and Other Types of Brake Control

In order to limit the subject within reasonable bounds, reference is made only to passenger car brakes now in use. These, in the order of their introduction, are the P. M., L. N., P. C. and U. C. equipments. The development of brakes has been brought about by a need to meet the increasing demand for transportation and to bring about certain necessary results, the end in view being safety of life and property and increased traffic with minimum cost.

The conditions to be met included increased weights, higher running speeds and greater frequency of trains. The objects to be attained were : (1) More flexible control of the train, greatly reducing possibility of shocks; (2) more uniform braking power; (3) constantly recharging auxiliary reservoirs, which increases safety; (4) better protection against excessive braking power service applications; (5) shorter, smoother and more accurate stops.

An up-to-date brake must be reliable, flexible and effective; reliable in that it must operate when required, and if there are any failures, they will be on the side of safety; flexible, in that certain retarding force between a minimum and fixed maximum can be obtained as conditions require; effective, in that it will result in a moving train being brought to a stop in a reasonably short distance.

P. M. Equipment

The P. M. equipment, first introduced in 1887, was known as the quick-action brake to differentiate it from the plain automatic brake of 1872. As cars became heavier and service more frequent, the pressure was increased from 70 lb. to 110 lb. and the high-speed reducing valve was added in 1894. For modern cars, with large brake cylinders and long trains, the use of P. M. equipment is undesirable, because: (a) Its function is materially affected by length of train and condition of valves; (b) effective service applications cannot to be obtained in quick succession due to the recharge all coming from the brake pipe; (c) of the liability of undesired quick action due to the same piston controlling both service and emergency functions; (d) of the inability to obtain quick action after a service application; (e) of the possibility of brakes creeping on due to fluctuations of brake pipe pressure; (f) of the possible loss of braking pressure without warning; (g) of the necessity of using valves of different size for various size brake cylinders.

L. N. Equipment

The P. M. equipment gave satisfactory service until the railways put into use passenger cars requiring brake cylinders 16 in. to 18 in. in diameter with proportionate size auxiliary reservoirs. The large brake cylinders and auxiliary reservoirs meant greater volumes of air to be handled in a given time. Also, it was necessary on account of the increased length of trains to obtain means whereby a more uniform service application be made, and to obtain a better control of the release of brakes. To meet these conditions and requirements the L. N. equipment came into use in 1908. It has the same general features of the P. M. equipment, with the following added: (a) Quick service; (b) graduated release; (c) quick recharge of auxiliary reservoir; (d) high brake force in emergency.

P. C. Equipment

The P. C. equipment was designed to meet the demand made on the air brake by the introduction of cars weighing 120,000 lb. or more. Heavier cars brought about the adoption of heavier and more powerful locomotives and the average speed of trains was increased. All this required a more efficient brake. This equipment possessed all the features of the older types with the following additional features: (a) Fixed flexibility for service operations; (b) certainty and uniformity of service operations; (c) quick rise in brake cylinder pressure; (d) uniform brake cylinder pressure, independent of piston travel; (e) maintenance of brake cylinder pressure against leakage; (f) limiting of service brake force to a predetermined amount; (g) service and emergency features widely separated, although controlled by the same piston; (h) automatic emergency when brake pipe pressure is depleted; (i) emergency brake force obtainable at any time.

This equipment did not come into general use.

Universal Brake Equipment

The U. C. equipment was designed and introduced for the same reasons as brought out the P. C. equipment and contains all its essential features. This equipment is made up of the following parts: One U-12 universal valve; one auxiliary reservoir; one service reservoir; one emergency reservoir (when two brake cylinders are required two emergency reservoirs are used); one brake cylinder (two brake cylinders are used when car weight exceeds 153,000 lb.); one conductor's valve; one centrifugal dirt collector; cut-out cocks, angle cocks, hose couplings, etc.

In order to obtain all the benefit from Universal Brake Control it is essential that an efficient foundation brake gear be provided. Up to recent years it was the prevailing practice to equip car trucks, of either the four or six-wheel

type, with brake rigging having but one brake shoe per wheel. With such a brake rigging it is impossible to keep the piston travel uniform. The shoe is hung below the center line of the wheel and when the brake is applied, brake hangers are pulled down, piston travel is lengthened, thereby increasing cylinder volume and causing a low cylinder pressure and a longer time than should be required to obtain it.

The disadvantages of using this type of gear may be summarized as follows: (a) Rough handling in starting due to violent taking of slack, slowing down and stopping due to slack action in train caused by unequal piston travel; (b) inability to make time because of train pulling hard on account of short piston travel, resulting in improper amount of shoe clearance and dragging brake shoes; long drawn out stops due to the engineer trying to avoid shocks by "dribbling" brakes on; (c) useless expense in excessive fuel and water consumption and reduced locomotive capacity due to the power necessary to overcome shoe friction; slid flat wheels due to uneven distribution of brake force; damage arising from shocks and break-in-twos as the result of short piston travel; hot boxes due to journal being pushed from under brass when brake is applied; burned brake shoes due to rubbing on wheel tread while brakes are released.

The clasp brake type of gear provides two brake shoes per wheel, hung practically on the center line of the wheel; this arrangement makes it possible to maintain piston travel constant for all cylinder pressures. The engineer is enabled to obtain the desired pressure with a given reduction of brake pipe pressure, thus insuring greater accuracy and smoothness in making stops. The brake shoe pressure is divided between two shoes and there is less wear of shoe metal.

It is well known that efficient handling of any train is the proper control of slack. All shocks are brought about by a sudden change of velocity of different vehicles in the same train, and the brake that will produce an effective retarding force with the least change in velocity between the front and rear portions of a train must be the best. Such a brake is one that when a brake application is desired, the brake pipe reduction and rise in cylinder pressure will occur simultaneously on each car in the train. The universal valve electrically controlled will do this efficiently and consistently.

The report was signed by Russell M. Smith (Penn.), chairman; H. H. Burns (Westinghouse Air Brake Company); E. F. Wentworth (New York Air Brake Company); J. R. Scott (St. L.-S. F.); Wm. Smith (B. & A.), and Jas. Fahey (N. C. & St. L.).

Discussion

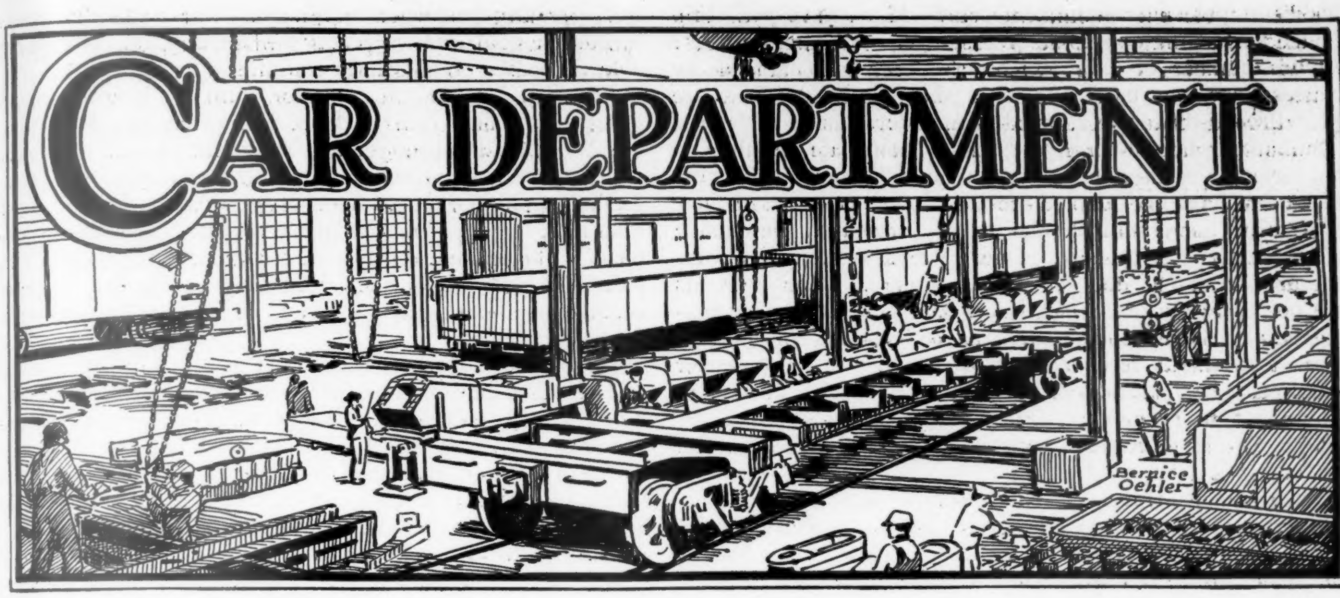
There was a long discussion of this report, one of the things which received the most attention being the graduated release feature. Several of the members maintained that it was advisable to use this equipment in direct release in view of the fact that mixed trains must be run. Other members strongly advocated having the graduated release cut in whenever 50 per cent of all of the cars have this feature. The advantages are a much better and more accurate control of passenger trains on descending grades and when making station stops. There is also a decrease in air consumption.

The possibility of getting an emergency after a service application with this equipment was pointed out, which is an advantage from a safety point of view. Care must be exercised not to get an emergency application at low speed, however, owing to the possibility of pulling out a drawbar. Another advantageous feature of this equipment is that by means of a special cut-out cock in the brake cylinder pipe, the brake on the car can be released without losing the reservoir pressure. This enables brake shoes to be replaced or brake rigging repaired without interfering with train line pressure or the reservoir pressure which maintains water level in the car. Another point which received considerable attention was the use of a back-up or tail hose when backing trains into stations, difficulty being experienced in getting accurate stops with this method.

President Kirby (B. & O.), summed up the matter in the statement that every train operated under normal conditions into Washington, D. C., is backed into the station by the engineman, operating the engineer's brake valve in accordance with communicating signals from the rear end.

Underwood & Underwood

A Pageant of the Overland Trail—the Pioneer Trapper, the Pony Express, the Prairie Schooner and One of the Union Pacific's New Mountain Type Locomotives



Master Painters Meet in Cleveland

Possibilities of Spray Painting and Protection of Steel Passenger Cars Thoroughly Discussed

THE Equipment Painting Section, Mechanical Division, American Railroad Association, held its first annual convention since 1920, at the Hollenden Hotel, Cleveland, Ohio, on September 4, 5 and 6. John Purcell, assistant to the vice-president, Atchison, Topeka & Santa Fe, and chairman of the Mechanical Division, prepared the opening address which, in his absence, was read by the secretary, V. R. Hawthorne.

Mr. Purcell's Address

An abstract of Mr. Purcell's address follows:

"You represent a department whose part in the successful operation of the railroads has been misunderstood and underestimated by the general public, as well as by a great many railroad officials; indeed, many painters seem to think that painting is done only for ornamentation. Improving appearances, while a desirable function of paint and varnish, is, after all, only incidental to the preservation of the equipment. On account of this misunderstanding your Section has not been given the recognition in the past that it deserves. You may be partly responsible for this, due to lack of unity in your recommendations as to the best methods to pursue. Your committee reports may not have always been positive enough in outlining the action that should be taken. Have you shaded your opinion to conform to general practice, when you knew the practice was wrong?

"Your responsibility has been greatly increased since the advent of steel car construction. Corrosion is the greatest enemy of steel or iron and as paint is the only method we have to prevent their deterioration, we look to your Section, through its committees, to try out and report the best materials that will accomplish this purpose. Do not leave it all to the committees. Be free, but fair in your criticism of reports; go on record with your opinion, whether it is for or against the reports. We expect you to devise economical methods of classifying repairs and getting equipment through the shops in the least possible time, consistent with the preservation of the equipment. You know the parts that are the most subject to corrosion. Do not fool yourself or your employer by thinking that because these parts are generally out of sight, that anything will do to get by. This is not economy, but a wilful waste of time and material that will eventually cause the blocking of shop output when the time comes that repairs cannot be further postponed. It is better to spend a dollar more for paint protection now than it is to later spend ten dollars for steel repairs.

"I would like to impress on you the necessity of having men trained ready to take the place of any man you have in your shops. One great fault of the paint foreman is failure to have men properly trained to do high-class graining or ornamental sign work, and then having recourse to the rather unfair method of recommending the elimination of the work and the substitution of another method which does not require as much skill but cheapens the appearance of the equipment and in reality costs more to maintain in the long run. Teach your men, and especially your apprentices, that the main function of paint is to preserve the equipment. Train your apprentices in the knowledge of what constitutes a good paint, what causes corrosion and how to prevent it, and you will be giving the company you work for the service that we all desire and that our stockholders are demanding."

Maintenance At Terminals

Several subjects having been assigned or referred to this committee for such action or report that said committee deems proper, this committee reports to Equipment Painting Division for their consideration as follows:

The subjects assigned to this committee were sent out to different railroads in the form of questionnaires, and 104 replies were received.

Question 1.—Do you use car renovators? Do you consider their use advisable, and why? There were 83 railroads using renovators, considering their use advisable, and 17 not using them, and 4 not operating passenger equipment. The committee deems it advisable to use renovators if they largely consist of vegetable oils, and not petroleums. Their use has a tendency to feed the varnish, and when used on interior of coaches, they add to the appearance.

Question 2.—Have you adopted enamel for the outside of

bodies of passenger equipment cars? If so, have you eliminated varnishing of outside of passenger car bodies entirely? Advise number of cars which have been so enameled by classes, how long used, and with what success? There are 12 railroads that have adopted enamel for outside of bodies, eliminating varnish entirely. Some of them state that they do not clean up readily as a varnish car. There were 87 railroads that have not adopted the use of enamel on all of their equipment, nor eliminated the use of varnish on the outside of passenger cars entirely. One railroad is using oil color because it can be done at a lesser expense. Four railroads are not operating passenger equipment. The committee taking into consideration the maintenance, cleaning and care of cars at terminals, recommends that the first class passenger equipment, be varnished on the outside of bodies, but at the option of the different railroads. Second class equipment that is not given terminal attention may be enameled outside of bodies, at shopping periods.

Question 3.—Have you used enamel on outside of passenger cars with varnish? If so, advise number of cars which have been so enameled and varnished by classes; how long used, and with what success? There are 33 railroads that have used enamel outside of bodies and then varnished them with success, stating that appearance and durability is improved.

Question 4.—Do you use flat color and varnish on outside of bodies of passenger equipment cars? If so, advise number of cars so painted, by classes, how long used and with what success? There are 77 railroads using flat color and varnish, 12 enamel, 1 oil color, 10 enamel and varnish, and 4 not operating passenger equipment. The committee, in view of the above, would recommend that on all passenger equipment that was considered as first class only, flat color and varnish be used. Considering the appearance, durability, maintenance and cleaning at terminals, this practice has been carried out on this class of equipment for many years, by a large majority of railroads.

Question 5.—Have you ever used enamel for outside of passenger equipment cars, and abandoned this practice and resumed use of flat color and varnish? There are 23 railroads that have used enamel, abandoned the practice and resumed the use of flat color and varnish, 12 using enamel, 1 oil color, 54 that were using flat color and varnish, 10 that were using enamel and varnish and 4 not operating passenger equipment. The committee recommendation is given in answer to Question 4.

Question 6.—Do you use gold for lettering of passenger cars? There are 69 railroads using gold leaf, 2 aluminum leaf, 1 copper leaf, 1 decalcomanias, 27 yellow paint, and 4 not operating passenger equipment. The committee, recommends the gold leaf, especially when using flat color on outside of bodies of passenger equipment.

Question 7.—Do you use color paint for lettering of passenger equipment cars? If so, with what success? There are 27 railroads using yellow color paint or gold color paint on all passenger equipment, 42 on all second class equipment, 29 using gold leaf on all passenger equipment, 1 using aluminum leaf, 1 copper leaf, and 4 not operating passenger equipment. The committee considers it advisable to use gold color paint on all second class passenger equipment, or when enamel or enamel and varnish is being used on outside of passenger bodies.

Question 8.—Do you use enamel or oil paint for painting of extensions on non-passenger carrying passenger train cars? There are 54 railroads not using enamel or oil paint for non-passenger carrying passenger train cars, but finishing same as their regular passenger equipment cars, 19 using oil paint, and 4 not operating any cars. Each individual road's local conditions would largely determine their practice.

The members of the committee were: A. H. Phillips (D. & H.), chairman; J. W. Houser (Cumberland Valley); J. Gratton (B. R. & P.), and J. N. Voerge (Canadian Pacific).

Report on Specifications

The committee of consultation on specifications for paints, oils, varnishes and paint oils, met with the Specification Committee of the Mechanical Division only once, although it corresponded with the chairman of that committee and gave its views, which in substance are as follows:

Specifications for mixed paints do not prevent the substitution of inferior goods. The latitude allowed by chemists in all their analyses is such that they are only an aid to the manufacturer, who is adept in using the lowest grade of materials which will pass the tests, or who strives to find a way to beat them. Only the simplest paint mixtures can be analyzed with any degree of accuracy and after the various ingredients are separated, it is exceedingly difficult to determine their quality. This is particularly true of pigments of which there are so many different grades, though all grades analyze practically the same.

Tests made by the committees representing the Equipment Painting Section have conclusively proved that a heat processed linseed oil properly treated will give better protection against the elements causing the deterioration of railway equipment than raw linseed oil, but the chemist will not

Courtesy of the Cleveland Press

Four Old Time Members Were in Attendance at the Convention—Left to Right: H. M. Butts, 73, Albany, N. Y.; C. E. Copp, 75, North Billerica, Mass.; Warner Bailey, 90, Concord, N. H.; and A. J. Bruning, 72, Evansville, Ind.

specify this class of oil in a paint because he cannot analyze it. Why insist on analyzing a cheap paint like mineral or carbon when we buy our high-priced primers, surfacers, enamels and varnishes upon their durability and appearance, and the reputation of the manufacturer to maintain the standard adopted after a practical test? Specifications should describe the service the paint will be subjected to and the color and finish desired. Specifications of this kind will give the expert paint manufacturers an opportunity to compete for business and railroad equipment will be given the protection it is so much in need of.

The question will be asked, "But how are we to determine whether the paint purchased will give us the protection desired before the paint is applied and put in service?" The answer is by film test. If a film of the paint, enamel or varnish is made and subjected to an accelerated test of the elements it will be required to meet in service, a determination of its ability to answer requirements can be made in a comparatively short time.

Specifications to determine quality of turpentine and turpentine substitutes, oils, etc., are deemed advisable and necessary by the committee.

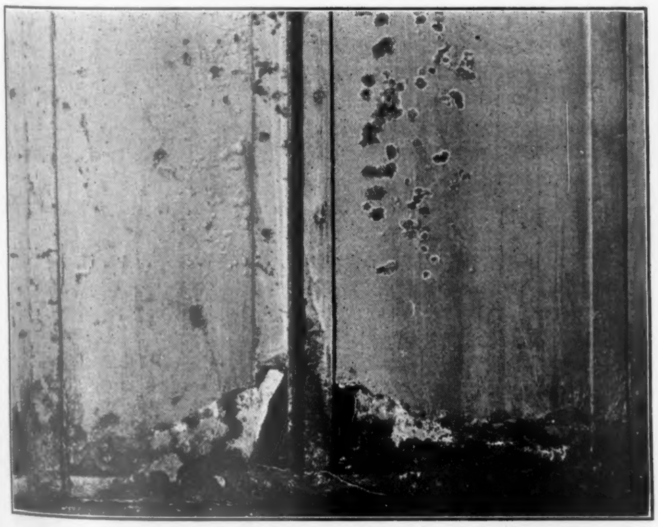
The report was signed by J. W. Gibbons, A. T. & S. F., chairman, and J. F. Gearhart, Penn.

Protection of Steel Equipment

The special committee was assigned several subjects pertaining to the preparation of steel equipment for paint and the best method of preserving it with paint.

Sandblasting

It seems to be the unanimous opinion of all painters that in the preparation of steel for painting or the removal of old paint for the purpose of repainting steel equipment, the sandblast is the most economical and presents a better surface for the paint to adhere to than any other known method. The question has been asked, "What is the advantage of removing old paint by sandblast over the emulsion or so-called



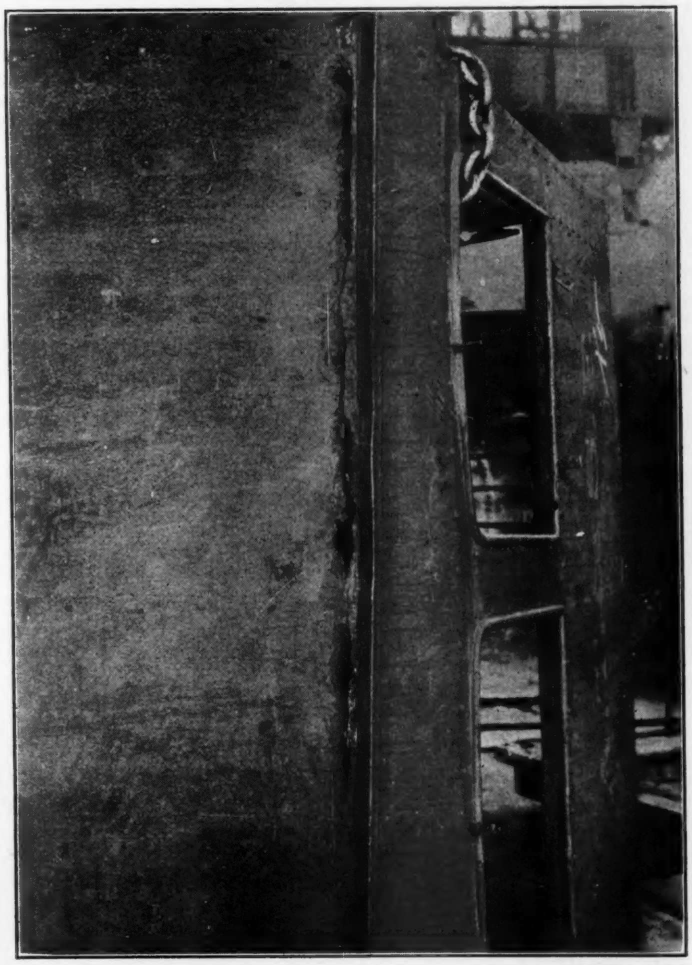
Effect of Corrosion on the Interior of a Steel Baggage Car

paint remover, if the mill scales are properly removed by sandblast before the initial painting of the car? Information as to the cost of removing paint by removers and sandblast obtained from shops in the eastern and western parts of our country, all indicates that paint can be removed by sandblast for one-half the cost by removers.

Outside the question of cost, the use of the removers that contain volatile matter (and they all do so except the alkali compositions) increase the fire hazards and are far more detrimental to the health of the operator than the sandblast. The sandblast will also remove all rust that may have accumulated, while the remover will not.

Bad results have been experienced from the use of emulsion paint removers. Cases have been reported where the remover would run into crevices where it was impossible to wash it out, and after the surface was primed and in some cases after the car had been finished, the remover would run out and destroy the surface. In other cases the paraffine base would not be thoroughly removed and when primers were applied, they would not dry uniformly.

The sandblast is the best method of removing paint from the interior and exterior of all steel equipment, unless the



Corrosion Through a Locomotive Cab Roof Sheet

sheets are so thin that the sandblast will warp the sheets. It will warp sheets of No. 22 gage unless they are thoroughly and closely braced.

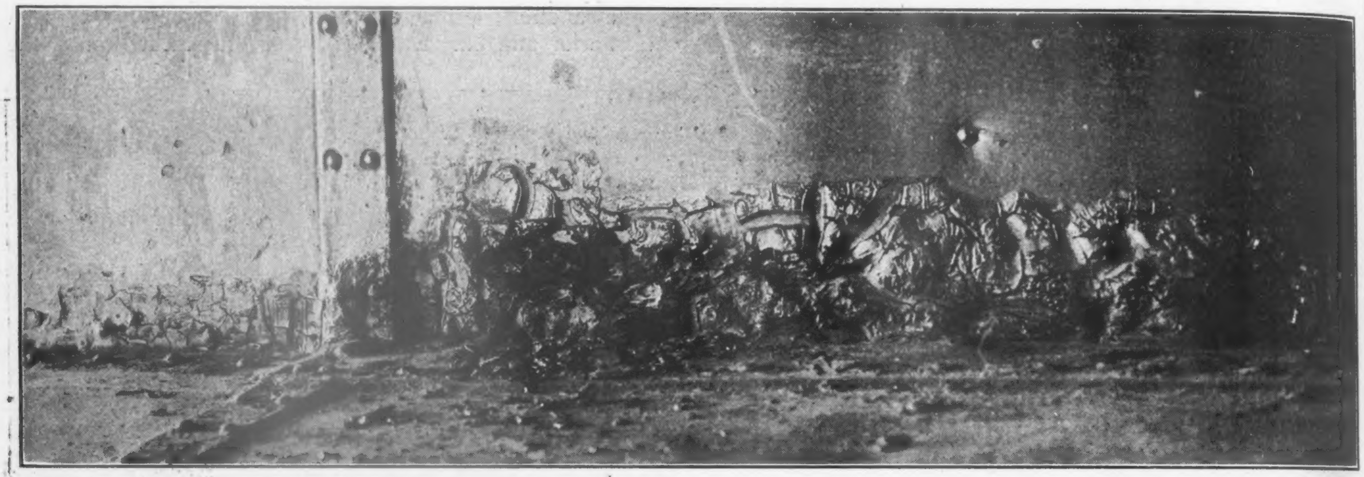
Corrosion

All parts of equipment where pockets are formed that will hold cinders, dust or gases, such as rain guards on roofs, window rails on cabs, deck sash on passenger equipment, steel underframes on locomotives as well as on freight and passenger cars, hold the coal dust and dirt and these, mixed with water, form an acid that accelerates the action of corrosion and quickly destroys the metal.

One of the photographs of the interior of an express car shows the sheets badly corroded several feet above the floor and entirely destroyed at the bottom. The principal reason for this was the construction of the car. Between the angle iron and the sheets, a copper plate was placed, evidently with the idea of making a tight joint and keeping out the moisture. This combination of three metals created an

electrical action when moisture was present that accelerated the corrosion. On the interior of the sheets a piece of cloth was pasted to assist in the insulation of the car. This cloth acted as a wick and carried the moisture up almost to the top of the car and caused the sheet to corrode as shown in the illustration.

The remedy is to construct all equipment so as to eliminate the cause as much as possible by making these parts dust and moisture proof, putting in drains and keeping them clean. The painter can assist in this work by painting these parts with good inhibitive coatings and filling up the crevices with some of the accepted plastic compositions that are now on the market for this purpose. All parts that are inaccessible after assembled should be given at least two coats of a proved inhibitive paint made as near water-proof as possible. A composition paint with a red lead or sublimed blue lead base, mixed with a proper heat treated processed linseed oil will give the most satisfactory service. This should be followed by one coat of carbon black mixed with the same grade of oil.



Corrosion at the Junction of the Upper Deck and Side Roof Sheets of a Passenger Car

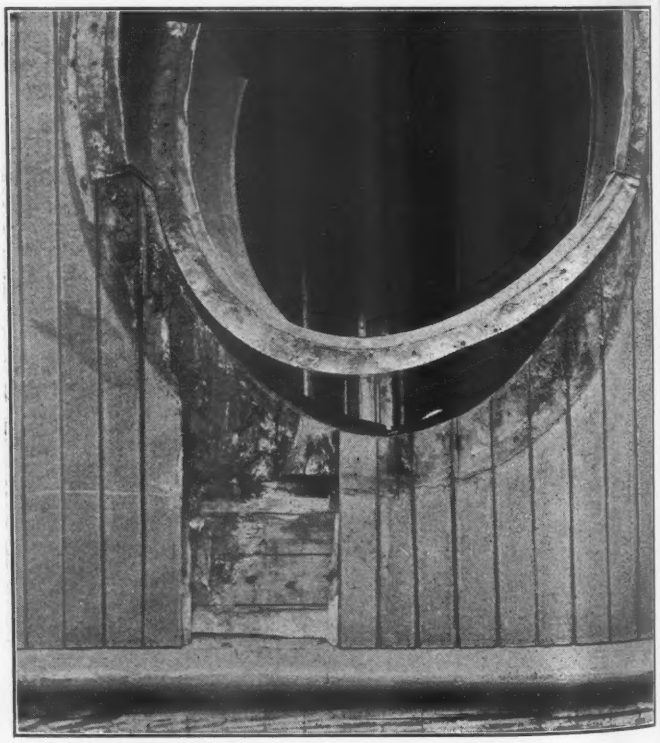
During assembly and fabrication all parts where metal is laid on metal should receive a thick coating of paste paint of the same materials as above. Steel freight equipment, steel roofs, underframes, etc., on all classes of equipment, should be sandblasted and given three coats of paint mixed as outlined above, the primer to be a composition of red lead or sublimed blue lead base paint mixed with a processed linseed oil. The second coat should be a mixture of the first and last coats, the third should be a proved acid resisting carbon paint.

In 1916 we were given permission by the Atchison, Topeka & Santa Fe, to paint two coal carrying cars with a paint of this character. They were inspected from time to time, the last time in February, 1923, just before going into the shop for repairs. The report showed the condition of this paint to be good, no corrosion having been started at any point under the paint. The only abrasions on parts of car where paint had come off were caused by mechanical defects or where ballast or other solid matter had struck the car, and there were only a few of these. The cars were in such condition from appearances that the paint would have lasted several years without recoating, but in order to protect the abrasions, orders were issued to touch up spots and apply one coat of carbon. With this evidence of the kind of protection that can be obtained by good paint, can there be any excuse for deterioration of equipment by corrosion? We have demonstrated in shops where the above instructions have been followed that it was possible to reduce the renewal of steel parts from an average renewal of 12½ per cent to less than one per cent of the parts where corrosion had taken its greatest toll prior to the time they were adopted.

One photograph shows the deterioration of a wooden car due to decay because of excess moisture. The same method of keeping moisture out of joints, laps and hidden parts should be followed as on steel equipment, except white lead paste should be substituted for red lead.

Spray Painting

In years past, there has been a prejudice against the application of paints by the spray method, which was the outgrowth of the crude sprays that were first used in the application of paint and the unwarranted exaggeration as to their virtues indulged in by men who thought they were catering to the wishes of their superiors for economy. This



Wood Sheathing Decayed by Moisture Entering at the Joints Around the Window

led to the wide use of what really should have been called a paint squirt gun which proved to be very expensive in first cost when cost of material was considered, and, owing to the unevenness of the coating, it neither wore well nor presented a creditable appearance. This prejudice took such a

deep root in the minds of the painters as well as the operating officers of the railroads, that the only method they saw for economizing was the elimination of all ornamentation. This was followed by the reduction of the number of coats of surfacers and varnish on both the interior and exterior of passenger equipment and on locomotives.

Last year we had the opportunity to see a train of steel cars finished under this system alongside of a train of cars painted with a good practical surfacer system protected with varnish. The first presented the rough appearance that can only be produced by applying varnish over a rough surface. If durability only was desired, why not save one coat by applying three coats of good oil paint that would have given better protection and would not have accentuated the rough appearance of the iron? With these facts before us, are we

All Coats Except the Knifing Coat Were Applied to This Tank With the Spray

to close our eyes to the great advancement that has gradually been made in the paint spraying devices in the past few years? One of the great objections formerly made against the spray was that the air passing through the paint, enamels or varnish left air bubbles in the paint film; and that the moisture in the air was detrimental to paint (Dr. Dudley, late chief chemist for the Pennsylvania, has advocated 5 per cent moisture in paint). Devices have been perfected that will remove the moisture from the air and spray guns are now in use that do not in any manner mix air with the paint, enamel or varnish, but only use it to atomize them so as to apply a good even coat on the surface to be protected or ornamented.

The committee submits photographs* of different classes of railway equipment that have been painted and varnished with "air guns." Every coat applied on these jobs except the kniving coat, was applied with the "gun." Note the smoothness, depth and brilliance of the surface on the locomotive tenders in the exhibit.

In view of our present knowledge of the improvements made and the increased demands for economy, are we fair to our employers, the public, or ourselves in letting our prejudices close all doors to economy except that which leads to uncleanliness and disease in turning out equipment that is not only uncouth but unsanitary?

Your committee, believing that the mind, disposition and to a great extent the health of the individual is affected by their surroundings, firmly believe that the traveling public are entitled to have their temporary home, the passenger car, maintained in a cheerful, sanitary condition, recommend that it is the sense of this division of the A.R.A. that the present tendency of destroying the appearance of the passenger carrying equipment is not in accord with good business principles or economy in upkeep.

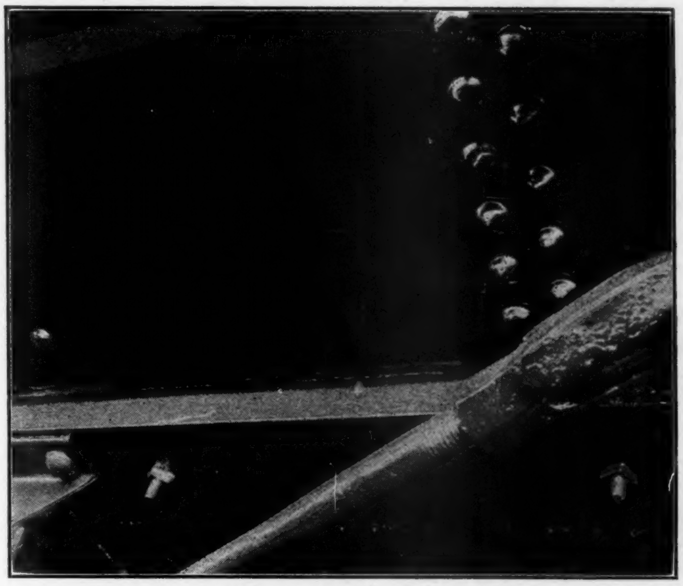
The members of the committee were J. W. Gibbons, A. T. & S. F., chairman; J. F. Gearhart, Penn., and A. E. Green, C. & N. W.

*The exhibits included photographs of steel underframe, wood sheathed baggage and express cars, which are not here shown.

Discussion

The sand blast was favored as the best means of removing paint, as recommended by the committee. Cases were cited where failure to get rid of all traces of the remover solution from cracks of other inaccessible places, had resulted in the destruction of the finish subsequently applied. Where an alkali remover had been used, the finish would not dry in spots. In one case these spots were still tacky when the car returned to the shop after a service of two years. J. T. St. Clair, acting engineer of car construction, Atchison, Topeka & Santa Fe, expressed the opinion that the time is not far distant when the railroads will insist on the use of the sand blast on new steel equipment to remove all mill scale and properly prepare the surfaces for their protective coatings. Calling attention to the photograph showing the badly rusted interior sheets of a baggage car, he said that about two feet of the lower ends of these sheets are now being applied as separate units, and that the backs of the sheets were coated with a heavy plastic cement.

The discussion on the use of the paint spray clearly indicated that the apparatus and the methods of using it have



A View Under the Running Board of a Tank Car Completely Painted With the Spray

been developed to a point where its practicability for a wide range of work is beyond question. There was, however, considerable difference of opinion as to the extent to which it should be adopted under the average unfavorable shop conditions. It was suggested that a certain portion of the shop should be set aside for the use of the spray, where carpenters and others would not be exposed to the mist thrown off by the spray. It was reported that there are now machines available with which the operator gets almost as close to the car as with a brush and from which very little mist is thrown off. It has also been found that with proper equipment a very slight current of air serves to keep the atmosphere surrounding the work free from any objectionable mist. The

discussion brought out the fact that the use of the spray is effecting net savings of from $1 to $3 each in painting box cars and from $5 to $20 in painting locomotives.

A resolution was finally adopted by the association in which was included the recommendation that materials known to be poisonous, such as white lead and red lead, should not be used in atomized form unless the vapors created can be eliminated or the operators, as well as others exposed, be safeguarded.

Classification of Painting Repairs

The shopping of cars should be determined by the length of time in service or the general condition of car. As a general proposition the class of painting repairs should be determined by the Paint Foreman on arrival of car at Shops, and should receive the following treatment according to class of painting repairs.

Schedule of Class A Repairs

Steel Dining or Private Cars

Outside Operations—Body—First day—Sand-blast and prime. Second day—No operation. Third day—Coat of surfacer. Fourth day—Putty and knife in pitted and uneven surface. Fifth day—Coat of surfacer. Sixth day—Coat of surfacer. Seventh day—Coat of surfacer. Eighth day—Rub with rubbing brick and water or rub to a smooth surface with sand paper or emery cloth in oil. Ninth day—Sand and touch up rubbed through spots, if any, with primer. Tenth day—First coat color. Eleventh day—Second coat color. Twelfth day—Letter and varnish. Thirteenth day—No operation. Fourteenth day—Varnish.

Note: Where flat color is used three coats of varnish should be applied. At shops where no sand-blasting is done but a standard paint remover is used in its place on all steel equipment the second day's operation should be priming.

Roof and Deck—First day—Sand-blast and prime with approved pigment and oil primer. Stand over at least 48 hours. Paint roof with two coats of standard roof paint. Paint deck with two coats of body color in oil or standard roof paint according to railway company's standard practice.

Trucks, Platform and Underneath Work—Trucks, platforms and battery boxes: Paint with one coat of oil color, followed by one coat of truck enamel. Underneath work, paint with two coats of oil color.

Inside Operations—When necessary to remove paint and varnish: First day—Remove paint and varnish with approved varnish remover or sand-blast. Second day—Prime. Third day—No operation. Fourth day—Surfacer. Fifth day—Putty and knife in pitted and uneven surface. Sixth day—Coat of surfacer. Seventh day—Coat of surfacer. Eighth day—Rub with rubbing brick and water or rub to a smooth surface with sand paper or emery cloth in oil. Ninth day—Sand and touch up, rubbed through spots, if any, with primer. Tenth day—Coat of ground color. Eleventh day—Coat of ground color. Twelfth day—grain. Thirteenth day—Varnish. Fourteenth day—Stripe, number and necessary notices applied. Fifteenth day—Varnish. Sixteenth day—No operation. Seventeenth and Eighteenth day—Rub to produce standard finish as required by railway company.

Note: The surfacer should be of a shade as close to the graining ground color as is possible to obtain.

Head Lining Operations—First day—Prime. Second day—No operation. Third day—Coat of surfacer. Fourth day—Sand and coat of enamel. Fifth day—No operation. Sixth day—Coat of enamel. Seventh day—Stripe.

Eighteen days consumed to finish this class of car, followed by two days for trimming, and O. K. on the 21st day.

Steel Coach

Outside Body—First day—Sand-blast and prime with approved steel car primer. Second day—Stand to dry. Third day—First coat of approved surfacer. Fourth day—Sand paper, putty, and knife in uneven and pitted spots, or whole car if necessary. Fifth day—Sand paper and apply coat of surfacer. Sixth day—Sand paper to a smooth surface and apply first coat of body color. Seventh day—Apply coat of car body coating or varnish color. Eighth day—Necessary lettering applied. Ninth day—First coat of varnish. Tenth day—Stand to dry. Eleventh day—Second coat of varnish.

Note: Where flat color is used three coats of varnish should be applied. At shops where no sand-blasting is done but a standard paint remover is used in its place on all steel passenger equipment the second day's operation should be priming.

Outside of body sash and end doors and both sides of vestibule doors to receive the same treatment as body of car.

Inside Operations—Where necessary remove old paint with sand-blast or varnish remover. First day—Prime with approved primer. Second day—Stand to dry. Third day—First coat of approved surfacer. Fourth day—Sand paper, putty and knife in uneven surface or whole car if necessary. Fifth day—Sand paper and apply second coat of surfacer. Sixth day—Sand paper to a smooth surface and apply coat of color, ground in Japan, thin to a brush coat with pure turpentine. Seventh day—Second coat of color as above. Eighth day—Lettering and ornamenting. Ninth day—First coat of varnish. Tenth day—Stand to dry. Eleventh day—Second coat of varnish.

If rubbed finish is desired stand to dry at least 48 hours before this operation. Eleven days consumed to finish this class of car, followed by two days for trimming and O. K. on the fourteenth day.

Note: Head lining, roof and deck, trucks, platforms and underneath work to receive same operations as those scheduled for dining and private cars.

Steel Mail, Mail and Baggage, and Baggage

Outside Operations—Body—First day—Sand-blast and prime. Second day—No operation. Third day—Coat of surfacer. Fourth day—Sand paper, putty and knife in uneven surface or whole car if necessary. Fifth day—Sand and coat of body color in oil. Sixth day—No operation. Seventh day—Finishing coat of body color in oil. Eighth day—Letter.

If the railway company's standard will not permit of the above appearances the schedule as applied to coaches, etc., can be applied. Roof and deck to receive same operation as those used on dining and private cars. Trucks and underneath to receive two coats of oil color.

Inside Operations—First day—Prime with lead primer. Second day—Putty. Third day—Coat of oil color, standard shade. Fourth day—No operation. Fifth day—Coat of oil color, standard shade. Sixth day—Paint steam coils, and guards, and necessary stenciling.

Note: The finishing coat for mail, and mail end of mail and baggage cars to be applied as per specifications issued by the United States Railway Mail Service. Eight days consumed to finish these classes of cars, followed by one day for trimming, and O. K. on the tenth day.

Wood Dining or Private Cars

The outside operations on this class of cars are the same as used on the steel type of coaches, with the exception that wood cars shall have the paint and varnish burned off.

Roof and Deck—Where canvas roof is applied, roof boards to be primed with a mineral paint. After canvas is applied, roof to be finished according to railroad's standard practice. Deck to receive three coats of body color in oil. When roof composition that needs no painting is applied, the deck to receive three coats of body color in oil. Trucks, platforms and underneath work to receive same treatment as applied to steel dining and private cars.

Inside Operations—When necessary to remove paint and

varnish with varnish remover: First day—Remove paint and varnish with varnish remover. Second day—Sanded and cleaned up by carpenters. Third day—Fill. Fourth day—Varnish. Fifth day—Stripe, number, and necessary notices applied. Sixth day—Varnish. Seventh day—No operation. Eighth day—Varnish. Ninth day—No operation. Tenth day—Rub with fine pumice and water. Eleventh day—Rub with rotten stone and oil.

Head lining to receive same treatment as applied to steel dining and private cars. Eleven days consumed to finish this class of car, followed by two days for trimming, and O. K. on the fourteenth day.

Wood Coach

Wood coaches receive the same treatment as wood dining cars, in and outside, roof, trucks, underneath work, etc.

Wood Mail, Mail and Baggage, and Baggage Cars

Outside Operations—When necessary to burn paint, which is very rare due to the use of body color in oil, the following operations to be applied: First day—Burn off paint. Second day—Sanded by carpenters. Third day—Prime with body color in oil. Fourth day—Putty and knife in if necessary. Fifth day—Sand paper and coat of body color in oil. Sixth day—No operation. Seventh day—Coat of body color in oil. Eighth day—Letter.

Roof and deck to receive the same treatment as accorded wood coach. Trucks and platforms and underneath work to receive same treatment as accorded wood coach. Inside to receive same treatment as accorded steel type of this class of cars.

Schedule of Class B Repairs

Steel Dining or Private Cars

Outside Operations—Car to be washed; after necessary repairs are made the following treatment to be accorded: First day—Prime new or bruised parts. Second day—Touch up parts with surfacer. Third day—Putty and knife in parts. Fourth day—Sand and color. Fifth day—Second color. Sixth day—Letter. Seventh day—Varnish. Eighth day—No operation. Ninth day—Varnish.

Inside Operations—First day—Prime new or bruised parts. Second day—Touch up parts with surfacer. Third day—Putty and knife in parts. Fourth day—Sand and ground color parts. Fifth day—Grain parts. Sixth day—Varnish newly grained parts. Seventh day—Varnish all over. Eighth day—No operation. Ninth day—Rub with pumice and water or oil.

Roof to receive two coats of standard roof paint. Deck to receive two coats of body color in oil. Trucks, platforms and battery boxes to receive one coat of enamel. Underneath work to receive one coat of oil color. Nine days consumed to finish this class of car, followed by two days for trimming, and O. K. on the twelfth day.

Steel Coach

The outside operations on a steel coach to be the same as those on dining and private cars.

Inside Operations—First day—Prime new or bruised parts. Second day—Touch up with surfacer. Third day—Putty and knife in parts. Fourth day—Sand and touch up new parts with color. Fifth day—Varnish all new work. Sixth day—Stand to dry. Seventh day—Varnish whole car if necessary.

If rubbed finish is desired, stand to dry at least 48 hours before this operation. Roof to receive two coats of standard roof paint. Deck to receive two coats of body color in oil. Trucks, battery boxes and underneath work, one coat of oil color. Platforms, one coat of enamel. Nine days consumed to finish this class of car, followed by two days for trimming, and O. K. on the twelfth day.

Steel or Wood Mail, Mail and Baggage, and Baggage Cars

After the car is washed and necessary repairs made, the following treatment to be accorded: First day—New or bruised parts touched up with body color, in oil. Second day—Putty. Third day—Sand and coat of body color in oil. Fourth day—No operation. Fifth day—Coat of body color in oil. Sixth day—Letter.

Roof to receive two coats of standard roof paint. Deck to receive two coats of body in oil. Trucks, battery boxes and underneath work, one coat of oil color.

Inside Operations—First day—New or bruised parts touched up with color. Second day—Putty. Third day—Sand paper, putty, and coat of baggage or mail car color. Fourth day—No operation. Fifth day—Coat of baggage or mail car color. Sixth day—Paint steam coils and guards, and necessary stenciling.

Six days to be consumed to finish this class of car, followed by one day for trimming, and O. K. on the eighth day.

Class C Repairs

Steel or Wood, Dining or Private Cars and Coaches

Car to be washed. After necessary repairs are made the following treatment to be accorded: Outside of car, new or bruised parts touched up with primer and surfacer, puttied, sand papered and cut in with color around letters and numbers. Apply one coat varnish. Roof to receive two coats of standard roof paint. Deck to receive two coats of body color in oil. Trucks, battery boxes and underneath work, one coat of oil color. Platforms, one coat of enamel.

Inside Operations—To be touched up and given only sufficient operations to make presentable and maintain railroad company's standard. Six days consumed to finish this class of cars, followed by one day for trimming, and O. K. on the eighth day.

Shopping

We would recommend that all first class equipment, steel or wood, be returned to the shops for attention at the expiration of 15 months. All second class equipment should be returned to the shops for attention at the expiration of 18 months.

All others, such as, excursion cars, etc., should be returned at the expiration of 21 months.

The members of the committee were D. C. Sherwood (N. Y. C.), chairman; W. N. Lamb (Penn.), M. Thierry (N. & W.), Thos. Marshall (C. P. R.) and W. Mollendorf (I. C.).

Discussion

Some objection was raised to the specific time allowances given by the committee. In answer, the chairman explained that the schedules were intended to meet average conditions, and were merely something to aim at, but that allowances could be made for conditions which made it impossible to meet them in detail.

Other Reports and Papers

Reports were also presented on Standards, Tests, and Safety and Sanitation. During the opening session the association was addressed by F. W. Brazier, assistant to the general superintendent rolling stock, New York Central, on the importance of Loyalty to the attainment of success. Moving pictures were also presented, by the Pullman company, showing the development of railroad cars, and the process of building Pullman sleeping cars. Abstracts of the above reports will appear in a later issue.

Election of Officers

The following officers were elected for next year: W. A. Buchanan (D. L. & W.), chairman; F. W. Bowers (Erie), first vice-chairman; A. E. Green (C. & N. W.), second vice-chairman.

Gasoline Motor Coach for the C. & N. W.

Trial Run Shows Practicability of Synchronized Double Motor Drive and Double End Control

A CHICAGO & NORTH WESTERN passenger coach of wood construction has recently been equipped with two gasoline motors, each driving on one of the trucks, by the Oneida Manufacturing Company, Green Bay, Wis. This arrangement of separate driving units has been made possible by the development of a system of synchronized electro-pneumatic control, installed in each end of the car so that it may be operated with equal facility in either direction.

The car recently made a trial run from Green Bay, Wis., to Pulaski, and return, after which it was turned over to the Chicago & North Western for further test under service conditions. On the trial run the easy riding qualities of the car and absence of vibration were noticeable, even at 45 miles an hour, the highest speed attained. The run was informal, no records being kept of speed, fuel consumption, temperatures, etc., but the car demonstrated its ability to run with either one or both driving motors in operation, when controlled from either end. A speed of about 20 miles an hour was made on the maximum grade of 0.7 per cent.

An interesting feature of the trial was the switching demonstration in which the coach was coupled to two loaded 50-ton box cars, which it readily moved back and forth on a siding. After the cars were started one motor was stopped and the other proved sufficient to keep them in motion.

This car has not been in service long enough to prove the present arrangement the most desirable in every detail. The two motors, for example, develop 70 hp. each and, with a loaded car weight of about 71,000 lb., the total weight per hp. is over 500 lb. If the car proves to be under-powered, higher rated motors can be readily applied, as the clutches and transmissions have been designed to transmit 140 hp. to each truck if necessary. A lack of adhesion to the rails was also noticeable on the trial run when the two pairs of driving wheels slipped in starting the loaded freight cars. It is believed that this condition can be improved by using larger steel wheels, instead of the present 33-in. cast iron wheels, and four wheel trucks in which a greater proportionate weight of the car will rest on the drivers.

Advantages in Design

The following are some of the advantages which the designers have endeavored to attain with the motor equipment applied to this car: (1) Safety of operation, secured by applying motor equipment to standard railway cars with no essential change in the car design; (2) reliability, obtained by using well established standard units for the motors, transmissions, clutches, air compressor, electric generating set, etc.; (3) low initial cost, by installing these standard units on equipment already owned by the railroads; (4) economy and flexibility in operation by using two relatively light, high-speed motors to get the car up to speed and then cutting out one; (5) electro-pneumatic, synchronized motor control, maintaining the speeds of the two motors the same within extremely close limits, well within the requirements for motors driving separate axles; (6) double end control, eliminating the necessity of turning the car at the end of its run, either on a turntable or wye; (7) arrangement for two or more cars to be coupled as multiple units and operated by a single motorman from the front end; (8) provision of two power units, enabling the car to reach its destination with one motor driving should the other become disabled; (9) a minimum number of gears in the transmission, always in mesh, reducing friction loss and preventing shifting or clashing of gears; (10) motor units readily detachable for repair or replacement. Should a number of

Fig. 1—Motorized Passenger Coach of the Chicago & North Western Ready for Branch Line Service

these cars be placed in branch line service from one terminal, one additional power unit can be repaired and kept in reserve, being quickly applied in case of emergency.

Description of Motor Equipment

The car selected by the Chicago & North Western for the application of Oneida motor equipment was the wooden frame coach No. 2680, equipped with six-wheel trucks, 33-in. cast iron wheels and 4¼-in. by 8-in. journals. This car weighs 62,000 lb. and seats 60 people. Fig. 1 gives the general appearance of the car, the pilot, the easily-detachable headlight, the horn and one radiator on the roof being plainly evident.

tion with a bus type generator. Both the starter switch and carburetor choker are of the Oneida remote controy type. Pneumatic speed regulation is provided and a hydrostatic

Comparative Motor and Car Speeds

Speed of car in miles per hour	Speed of engine in R. P. M. 500	1,000	1,500	1,750	2,200
1st speed	1.88	3.76	5.64	6.58	8.3
2nd speed	4.91	9.82	14.73	17.18	21.6
3rd speed	9.82	19.64	29.46	34.37	43.2

governor gives uniform control from 250 r.p.m. to 2,200 r.p.m., the maximum speed. The air cleaner is of the centrifu-

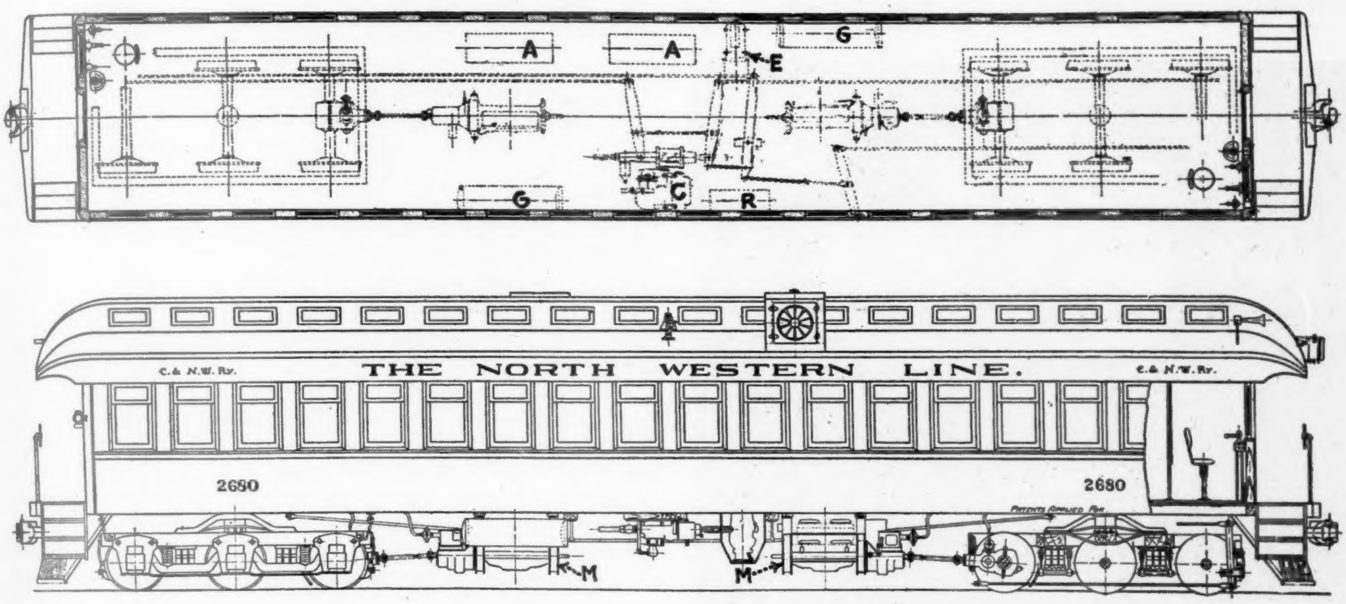


Fig. 2—Plan and Elevation Showing Arrangement for Double Motor Drive and Controls

The arrangement of the driving mechanism and auxiliary units used on the car are plainly shown in Fig. 2.

Practically no change was made in the internal arrangement of the car in applying motor equipment with the exception that the longitudinal seat in each end was removed and replaced by the driver's seat and control apparatus. Referring to Fig. 1, the air reservoirs are shown at *AA*, air

gal type. A Cotta unit power plant transmission is used, the gears, which are constantly in mesh being provided with sliding clutches. The gear ratios are: Low, 5.2 to 1; second, 2 to 1; high, 1 to 1. Detlaff disc type clutches are used, having nine discs, pneumatically controlled.

Synchronizing is accomplished through the medium of equalized air pressures. The selection of the gears only is

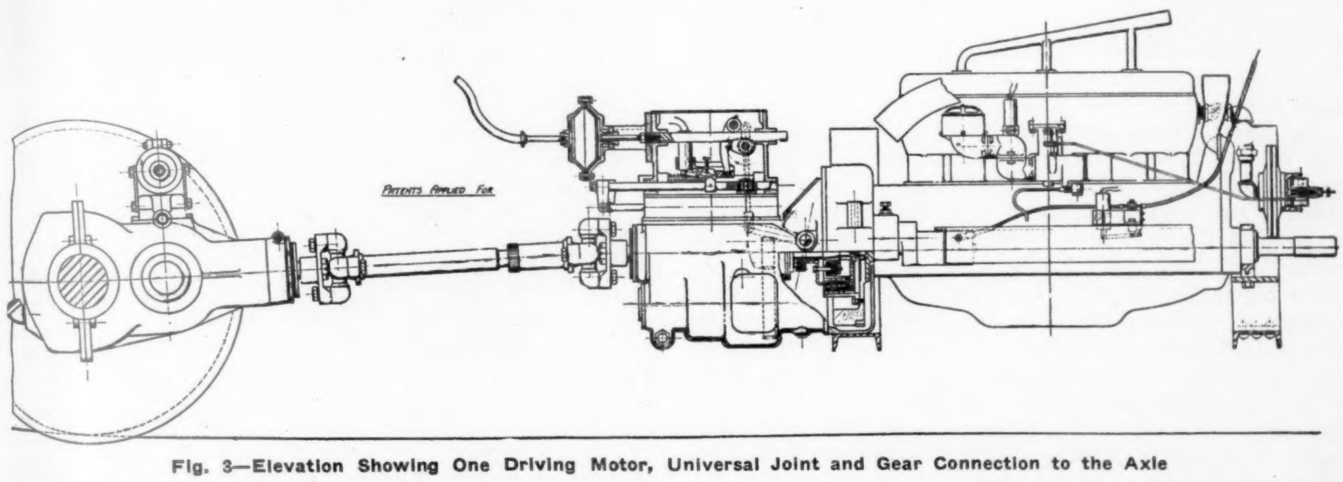


Fig. 3—Elevation Showing One Driving Motor, Universal Joint and Gear Connection to the Axle

compressor at *C*, electric generating plant at *E*, gas tanks at *GG*, auxiliary reservoir at *R* and driving motors at *MM*. The driving motors are Model 6-B, Continental Red Seal, rated at 70 hp. at 2,200 r.p.m. They are of the six cylinder type with 3-3¼-in. bore and 5-in. stroke. The comparative motor and car speeds are shown in the accompanying table.

A Bosch high tension ignition system is used in conjunc-

accomplished through low voltage solenoid operation, while the work of shifting is performed by air pressure. The hydrostatic governor is directly connected to the water jacket of the motor, the pressure in the water jacket depending on the speed of the motor. The counteracting pressures which regulate the speed of the motor from the operator's control are produced by compressed air. This is the type of construc-

tion which makes it practicable to utilize a number of power cars in a train, all of which are controlled from one station by one operator.

The clutch and gear shift mechanism are pneumatically operated in unison. A double reduction gear is used on the axle, arranged for equal speeds in either direction with pneumatic reversing control; the ratio is 5 to 1. The tongue arm is spring-mounted to the truck frame and the suspension is such that the unit can be quickly removed or installed. The gasoline tank capacity is 52 gal. per motor unit.

A Modine-spirex double core radiator for each unit is mounted on the roof. The fan is provided with electric thermostatic control whereby it cuts in at 160 deg. F. and

Fig. 4—Duplicate Controls Are Located in Each End of the Car

cuts out at 150 deg. F., independent of motor speeds. During the trial run this fan started as soon as the car stopped but while the car was in motion sufficient air passed through the radiator to keep the cooling water temperature below 150 deg. F. A centrifugal pump circulates the water in the cooling system, which has a capacity of 20 gal. Special arrangements are made for operating in low temperatures.

The speed control is pneumatic, operated either by hand lever or foot pedal. The pneumatic gear shift and clutch are also operated by a hand lever. The gear selection, motor start and stop control are operated by hand levers and interlocked with the pneumatic control to make the arrangement positive and fool proof.

The air brake equipment is of the Westinghouse type and consists of a two-cylinder, 10-in. compressor, directly connected to a 1½-hp. 110-volt motor, equipped with the necessary regulating and controlling valves, two 14-in. by 48-in. air reservoirs and a standard controlling valve. On the car illustrated, brake shoes are applied on four wheels of each truck. The brake control system is arranged for both automatic and straight air application.

The car carries a Kohler four-cylinder, 2,500-watt, 110-volt, direct current, generating set which furnishes current for the interior lights, ventilating fan, headlight, radiator cooling fan and air compressor motor. This generating set is automatic in operation. Whenever a switch is turned on the generating set starts. All the accessories are thus separated from the power motors which need not be operated simply to provide air pressure or electricity. Moreover, a uniform speed of the air compressor is secured and there is no need of large storage battery capacity. This car is equipped with one small 24-volt battery. A double air-operated sander, Golmar automatic bell ringer, 250-watt headlight with dimmer and Strombos whistle complete the equipment of the car.

An operator's compartment, located at each end of the car, is enclosed by curtain *M*, Fig. 4. Two tell-tale lights *A* are provided to indicate whether or not both motors are operating; *B* is the air brake valve; *C*, the clutch throw out and gear shift; *D*, the duplex air brake gage; *E*, the electric speed selector; *F*, the sander valve; *G*, the governor valve, and *H*, the air-operated bell valve.

New Lock Lifter for Type D Coupler

TYPE D Couplers have occasionally given trouble in service on account of the lock lifter working out of the lock causing the coupler to become inoperative. In order to correct this, the Mechanical Division of the American Railway Association has brought out a new design of lock lifter as announced in the following circular issued by the division.

The Committee on Couplers and Draft Gear has had called to its attention recently some trouble with the lock lifts of the D couplers, wedging or sticking when the coupler is in locked position. In extreme cases, the lifter could not be raised sufficiently to unlock the coupler, making it necessary, therefore, to remove the coupler from service.

An investigation of this trouble developed that the lifters of a few of the D couplers were working their way down

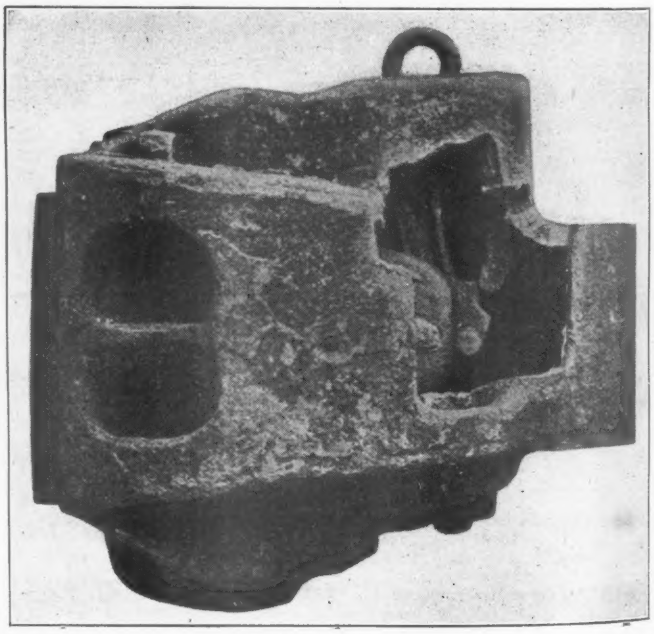


Fig. 1—Lock Lifter Out of Place, Making Coupler Inoperative

under the anti-creep ledge as indicated on Fig. 1 which shows this development in a coupler removed from service. This condition is brought about by extreme wear combined with minimum gage parts in the coupler.

In order to overcome this trouble, the design of lifter has been slightly modified to compensate for wear that has developed and application of the modified lifter to couplers giving trouble in service has corrected the same. Fig. 2 shows the relation between the lifter and anti-creep ledge

with a modified lifter applied to a coupler that was giving trouble in service. Fig. 3 shows the new and the present design of the lifter and will be of assistance in distinguishing the two designs. The modified lifter is interchangeable with the present design and all lifters manufactured in the

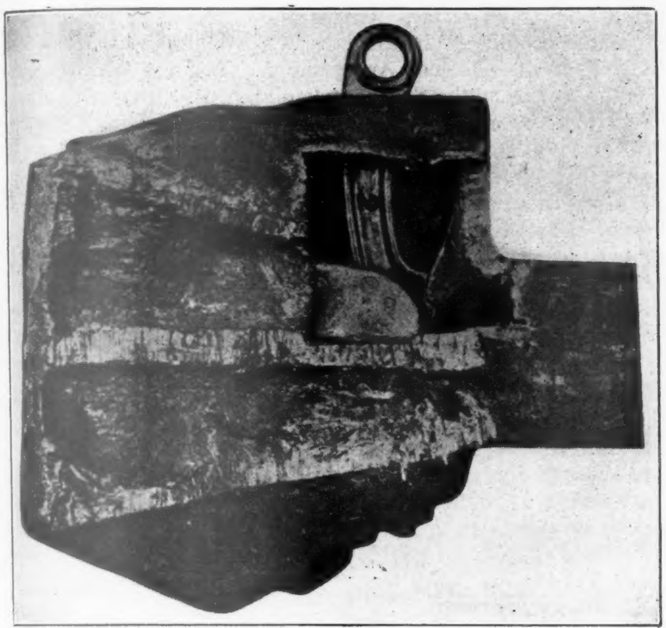


Fig. 2—New Design of Lock Lifter in Type D Coupler

future will be of the modified design. This modified design of lock lifter is designed as the D coupler lock lifter No. 2.

When D couplers are found to be inoperative on account of

Fig. 3—New Lock Lifter for Type D Coupler (at left) Compared with Former Design (right)

the lifter wedging, as above indicated, the modified design of lifter should be applied. The coupler manufacturers are in position to make immediate deliveries on the modified design.

Recent Decisions of the Arbitration Committee

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Responsibility for Failure to Stencil Air Brake Cleaning Date

The Philadelphia & Reading made a repair card showing the cleaning of the cylinder and triple valve of Bessemer & Lake Erie car No. 9560 on January 29, 1921. The New York Central made a repair card dated September 16, 1921, showing the cleaning of the cylinder and triple of the same car, on account of "no date." The car returned to the home line on March 6, 1921. The owner requested the Philadelphia & Reading to cancel its charge for the repairs reported on January 29, on the ground that the repair men had failed to stencil the car, thus giving the New York Central the right to re-stencil and render bill. The Philadelphia & Reading refused to grant this claim on the ground that the New York Central did not make proper effort to locate the stenciling and because the owner failed to secure joint evidence when the car returned home, as required in Rule 13. The Bessemer & Lake Erie maintained that the absence of stenciling upon a car to show when the triple was last cleaned cannot be considered improper repairs, that the absence of the stenciling made the car subject to cleaning at the owner's expense and that no further responsibility rested upon the interchange inspector or any other inspector. This road also pointed out that Rule 90 provides that the billing repair card of an intermediate line shall be final and shall perform the same function as a joint evidence.

The Arbitration Committee decided that: "In a case of this kind car owner cannot be expected to obtain joint evidence on arrival of car home. Rule 90 applies. The contention of the Bessemer & Lake Erie is sustained."—*Case No.* 1251, *Bessemer & Lake Erie vs. Philadelphia & Reading.*

Substitution of Steel Tired for Wrought Steel Wheels, Improper Repairs

The Bessemer & Lake Erie received its car No. 80934, December 5, 1920, with two pairs of steel tired wheels in place of the wrought steel wheels standard to the car. A joint evidence card was obtained and presented to the Northern Pacific, which had applied the wrong wheels on August 31, 1920. The Northern Pacific refused protection because of the extensive use of steel tired wheels and the common practice of substituting one type of wheels for the other in both freight and passenger equipment. The owner contended that the A.R.A. rules did not permit the substitution of steel tired wheels for other wheels, and that no wheel could be substituted for the wheel standard to the car, provided that the wheel standard to the car was an A.R.A. standard. The Northern Pacific stated that "There is no question but that steel tired wheels are a much better and safer class of wheels than the cast steel wheels which are considered to be amply safe for use in freight equipment." The owner maintained that steel tired wheels were only used in locomotive and other special service, and were not considered

safe any longer for freight service. On this the Bessemer based its claim that the steel tired wheels should be charged out at normal prices as scrap wheels, and credit allowed for the same amount at the time of removal and scrapping

The Arbitration Committee rendered the following decision: "Wrought steel wheel is A.R.A. standard. Substitution of steel tired wheels constitutes improper repairs, and the road making the repairs is responsible per Rules 16 and 87."—*Case No.* 1257, *Northern Pacific vs. Bessemer & Lake Erie.*

Net Store Department Costs Applicable on Non-Standard Roof

Northern Pacific box car, No. 43809, underwent heavy repairs at the Louisville, Ky., shops of the Louisville & Nashville. The repairs included the renewal of one complete outside Murphy improved X.L.A. metal roof, for which a charge of $108.47 was assessed, based on actual store department costs. The Louisville & Nashville contended that it was justified in charging the above amount, inasmuch as this was non-A.R.A. material and the repairs as made were authorized. It was also contended that the L. & N. was not aware at the time the repairs were being made, that the car owner's standard was not being maintained, as the roof removed was badly corroded and it was impossible to tell the gage of the iron. The Northern Pacific claimed it had been sufficiently penalized in being required to accept a non-standard roof without the additional penalty of having to pay 100 per cent more than the price of the standard roof; that galvanized iron roofs, which could be purchased at a cost of $57, were standard to this car, and, that the price of the material applied should not exceed the cost of the standard roof. It also thought it necessary to have some kind of restrictions to protect the car owner against the application of expensive specialties.

The Arbitration Committee decided that: The bill of the Louisville & Nashville on basis of their net store department cost is sustained."—*Case No.* 1258, *Louisville & Nashville vs. Northern Pacific.*

Bill for Improper Roof Repairs Confined to Labor

On October 17, 1920, the St. Louis-San Francisco forwarded to the Central of Georgia a joint inspection certificate covering defects requiring the renewal of underframe sills, body posts and braces, and decking and siding to the extent of practically rebuilding the superstructure of the car. The certificate, however, did not specify any roof defects. The estimated cost of repairs was labor, $280; material, $450. Through the oversight of the foreman in rendering the joint inspection statement and subsequent defects found upon dismantling the car, the final cost of repairs amounted to $1,213.-72. The Central of Georgia refused to grant the St. Louis-San Francisco authority to bill for the full amount, and held that road to the amount of their original estimate, plus the $50 tolerance allowed by the rule. Among the additional items was the renewal of the roof. Instead of ordering a metal roof from the car owner, the foreman equipped the car with a double-board roof. On arrival of the car home the Central of Georgia claimed improper repairs and a defect card was issued, on which a bill was rendered in the amount of $144.63. The St. Louis-San Francisco claimed that under the rules, the repairing road should be reimbursed for the labor and material expended in making improper repairs and that, upon correction of such repairs, the car owner shall recover on the authority of the defect card.

The decision of the Arbitration Committee stated that the bill of the Central of Georgia for improper repairs should be confined to labor only, according to Rule 88.—*Case No.* 1259, *St. Louis-San Francisco vs. Central of Georgia.*

Cleaning Air Brakes More Than Once Within 60 Days

The Midland Valley was billed for cleaning the air brakes on its car No. 3828 by the Southern Pacific three consecutive times within a period of 40 days. On April 11 the Southern Pacific made repairs to this car at its Sacramento, Cal., shops, a part of which was for cleaning, oiling and testing the cylinder and triple. On May 11, the same road made the same repairs at its Mojave, Cal., shops and again on May 21 at its Tucson, Ariz., shops. The car was in continuous service on the Southern Pacific Lines during this time. Objection was made to the frequency of these charges by the Midland Valley, which contended that if the work had been properly performed in the first instance, the two subsequent cleanings should not have been necessary. The Southern Pacific claimed that while the triple valve may not have been as dirty as it would have been had it been in service several months, it could accumulate enough dirt to render it inoperative; that scale or grit might be blown into the triple from the branch pipe at any time.

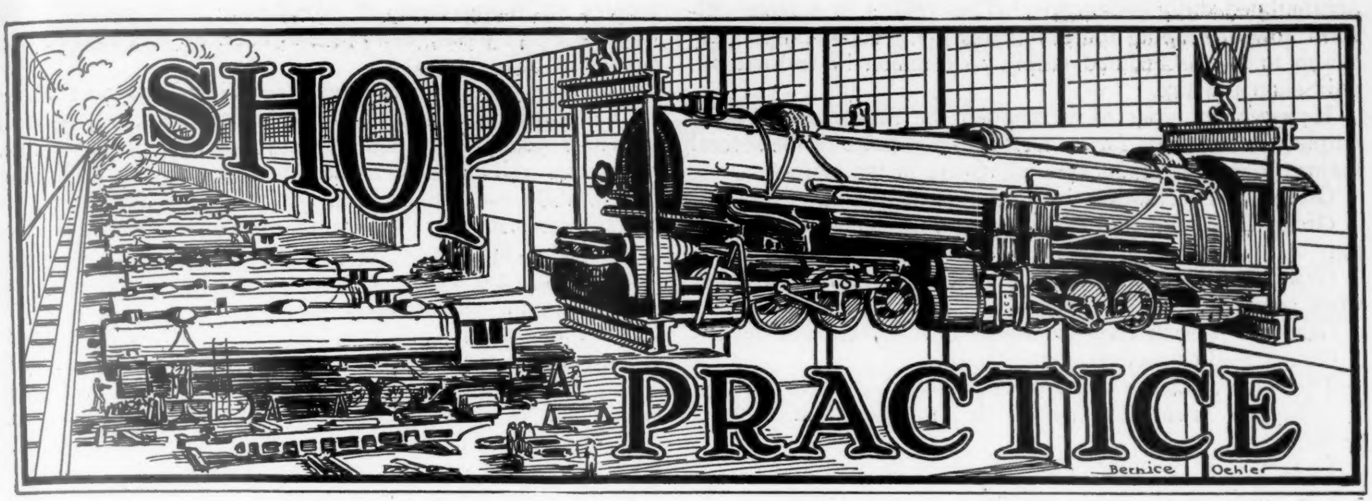
The Arbitration Committee's decision states that: "In such cases where the air brakes have been cleaned more than once on the same road, within 60 days, the expense of such cleaning should be assumed by the handling line. Therefore, charge for cleaning air brakes May 11 and May 21, 1921, should be withdrawn."—*Case No.* 1260, *Midland Valley vs. Southern Pacific.*

Responsibility for Damaged Car Due to Weak Construction

Pere Marquette box car No. 31132, 60,000 lb. capacity, was damaged while being handled in a Lehigh Valley train going up the mountain at Kelly's Run, October 20, 1921. There were 77 cars in the train, this car being the forty-eighth car from the head end. There were two engines ahead and one pusher engine behind, which did not have the air connected to the train. The train parted between the sixth and seventh cars, which caused the air to go into emergency. The body of the Pere Marquette car was crushed, humped in the center and the sides bulged out. After the strain of the train was released, the center of the body of the car dropped down on the track, due to the weight of the load. There were no wheels derailed, neither was the body of the car off center.

The total cost of the repairs was estimated by the Lehigh Valley at $1,221.60. The Pere Marquette objected to this amount, contending that after the train broke in two, the pusher engine, not being affected by the emergency application of the brakes, continued shoving the remaining cars, thereby causing the damage. It maintained that where it is necessary to handle trains in this unusual manner the handling line should be responsible to the owner for damage done to their equipment; that the fact that the body was entirely destroyed and the center of the car crushed and down on the rails, indicated rough handling, and that the owner should not be put to the expense of rebuilding or settling on a salvage basis. The Lehigh Valley stated that examination showed the car had 5-in. by 8-in. center sills to which the emergency draft arms were applied. These sills were apparently the original sills applied when the car was first built. It contended that the destruction of the car was due to its light center sill construction which failed in ordinary handling of the train.

The Arbitration Committee decided that: "The car was damaged as the result of an emergency application of the air brakes, due to parting of the train. There was no evidence of derailment or other unfair usage. Therefore, the damage to the car is the owner's responsibility."—*Case No.* 1261, *Lehigh Valley vs. Pere Marquette.*



Locomotive Scheduling at the Silvis Shops

Part 4—Performance

New Schedule System Designed to Provide Centralized Control of Production and Accurate Cost Data.

By L. C. Bowes,* G. F. Sandstrom † and H. K. Robinson‡

IN the previous articles the complete cycle of centralized production and cost control have been outlined, and the potentialities of that within itself have been indicated. The biggest of all problems now presents itself, namely, that of cutting in and establishing the required functions and routine together with building up and unifying the personnel of the required organization. The problem divides itself into two main divisions—which are:

1. Technical.
2. Morale.

While the technical end is extremely difficult to establish, this difficulty is secondary to the possible difficulties encountered in creating the proper morale which, after all, is the keynote to the success of any endeavor irrespective of any other features that the endeavor may have to recommend it.

High Morale Essential for Successful Operation

Too much stress cannot be laid upon the fact that in the absence of this unified organization and high morale, failure only can attend the endeavor, even though the principles adopted and details established be perfect within themselves.

In order to obtain the necessary morale for the successful operation of any new organization it requires—

1. The complete understanding and faith of everyone connected therewith, not necessarily as to details but as to the principles involved, and the potentialities possible from the standpoint of true management.

2. The complete delegated authority to and co-operation of all officers and division heads connected therewith, together with a hearty and active support of the management as a whole.

While it seems unnecessary to point out that many hardships and discouragements are contended with establishing a re-organization program, the fulfillment of the requirements enumerated above is of vital necessity in order that such hardships and discouragements be surmounted and the program carried to completion in the most successful and harmonious manner.

While it appears that the above is a digression, the object in bringing out these salient and necessary factors is because of the fact that there is always a danger of treating any new endeavor as a mystic and not understandable unique cure-all. There is a proneness in human nature, when the "new" presents itself, to sit on the side lines and clamor for immediate and tangible results. Such cannot be the case, however, as by reading the foregoing articles, it can be very well seen that centralized production and cost control has no mystic power, but consists of nothing more nor less than *Common Sense Systematically Applied.* Further, it may be seen that immediate and tangible results cannot be expected, but the success lies in recognizing the potential possibilities. By the same token, it is most unfair to attempt to measure the success and correctness of principles involved and details established by the immediate returns. This is due to the fact that it is not possible to apply any one complete program at one time, for as it is well known, and by reason of engineering procedure, the real and final program must evolve itself and find its own operating level under the conditions necessary and peculiar to the particular activity. Therefore, the only attempt has been to outline a program which is correct in principle, leaving the measure of actual results and routine to the time when the momentum created will swing itself into its own course.

Maximum Daily Output Obtained under Unit System

The proposed measure of output will be based on the analysis and creation of a capacity measured by average standard unit man-hours, instead of actual number of locomotives as heretofore. Further, instead of making a supreme effort on monthly locomotive output, such effort should be concentrated on a maximum daily production. Thus it is seen, by such a program of maximum daily production, the monthly output will automatically take care of itself, such monthly output being merely a post-mortem reflection of the

*Production engineer, C. R. I. & P. †Industrial engineer, Roberts-Pettijohn-Wood Corporation. ‡Special accountant C. R. I & P.

accumulated daily production. This results in a more uniform flow of output, and eliminates the "end of the month" spasm to meet scheduled output so common in railroad repair shop practice.

However, in order to accomplish the maximum of daily output, the condition forces itself into a balance of the several major progressive operations, which are in the main—

Group 1—Locomotives in process of stripping.

Group 2—Locomotives blocked and in early stage of repair.

Group 3—Locomotive boilers tested o. k. signifying boiler work complete.

Group 4—Locomotives on wheels in final stages of repair.

Group 5—Locomotives breaking in.

The correct balance of all of these groups directly affect—

Group 6—Locomotives o. k. to Transportation Department.

Thus it is very evident that, in order to meet and obtain a true reflection of these conditions, the unit system is the only one that lends itself to correct visualization. By virtue of correct visualization, which presupposes daily rather than monthly blanket scheduling, it makes possible the opening up and immediate remedy of all delays to production. By means of this daily scheduling, certain geometric formations of the red tickets on the master schedule board (See Fig. 1, July issue) indicate without further analysis the balance of the sequence of the several progressive operations. For example; if the formation of the red tickets is that of an inverted triangle, with the lower point of the triangle on the last division of scheduled operations, and the heavy portion of the triangle in the first division of schedule operations, it is reflected immediately that the shop is in a reverse condition and the groups aforementioned are not properly balanced. For proper balance, which means uniform output, the position of this triangular formation should be such that the point is on the first division of the scheduled operations and the heavy portion of the triangle is on the last division.

While it should be remembered that there should be no red tickets, however, this example is merely brought out to show that the latter formation reflects a condition which, no doubt, is possible of immediate remedy, inasmuch as the heaviest work has already been completed.

Another great factor in daily scheduling and subsequent performance is brought out by the fact that the master schedule board is a graphical representation of the paths of progress of the locomotives in the shop, and any interference of these paths, one with another, reflects immediately without further discussion, a physical interference of work in the shop. Such interference could not possibly have been apparent until it actually occurred, unless by some such means of graphical reflection it could have been predetermined.

The reason for laying stress on the connection between performance and daily scheduling is that, *no routine forms* are necessary with the exception of the two already existing forms, namely, production and material tickets which are always necessary in any shop under any system.

Such a system as it has been attempted to describe in its elements and basic features is all very well within itself. It is a means of providing for necessary intensified functions and routine, which, combined with the proper operating policy, permits of a program of maximum production.

Manufacturing Separated from Stripping and Erecting

The general procedure common to a railroad locomotive repair shop is as follows: The locomotive is brought into the shop, stripped and parts stripped distributed to the various departments for replacement or repair. When such activities have been completed, parts are again assembled and placed on locomotive. It can be readily seen that such a procedure is of necessity a direct hindrance to speedy output, in that the locomotive is held out of service until repairs or replacement of parts have been made. This hindrance is a result of failure to open up and intensify on each particular endeavor.

Therefore, the thought presents itself of the possibilities of a radical departure and extreme program, whereby all activities would be opened up, and would be intense within themselves and have no immediate relation with each other but would solve the problem of speedy production. This necessitates primarily the forming of two general and distinct divisions of locomotive repairs, which are—

1. Manufacturing: a—New parts; b—Repairing old parts.
2. Stripping and erecting.

The manufacturing endeavor will be carried on irrespective of locomotives currently in the shop, but will be based upon a blanket program of having necessary parts ready to apply to locomotives when they do reach the shop. Further, the capacity of such manufacturing activity is entirely separate from the locomotive capacity of the repair shop.

By the same token, the locomotive capacity is irrespective of the manufacturing division. Therefore, the output of locomotives under such a program assumes a new and startling aspect, in that the measure of capacity will be governed by the capacity of stripping and erecting only.

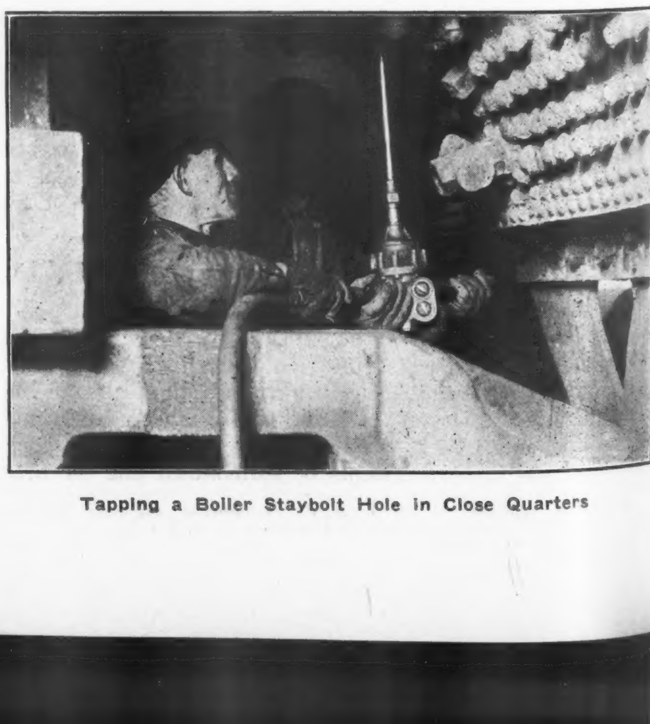
Applying this program to a shop built for an output of 60 locomotives per month under the heretofore generally accepted measure of capacity, and remembering that the manufacturing problem becomes a problem of itself, such a shop has a potential capacity of 180 locomotives per month.

For example; it is generally conceded that the time of repairing a locomotive may be divided as follows:

Stripping	10 per cent
Repairing	67 per cent
Erecting	23 per cent
Total	100 per cent

Thus it is very evident from applying this new program that the locomotive production is increased in the ratio of three to one, or that 67 per cent of the time (roughly two-thirds) has been eliminated so far as locomotive capacity is concerned, and has been taken care of by the manufacturing capacity. Such a program presupposes a very careful analysis and an established schedule of shopping which must be strictly adhered to. This program has been exploited at this time in the extreme and any practical application will find its own level as governed by existing conditions.

This article concludes the attempt to bring out the salient and controlling features, as governed by the basic principles of true management, as applied to the repair of locomotives. Constructive criticism is invited with the hope that something tangible will be accomplished in bringing about a solution to a problem which has been paramount for many years.



Tapping a Boiler Staybolt Hole in Close Quarters

Setting Valve Gears of the Radial Type*

A Rapid Method of Setting and Adjusting Radial Valve Gears Without Rolling the Wheels Is Described

By S. P. Kennedy

THE quickest method of setting and adjusting the different types of radial valve gears without resorting to rolling the wheels is based on the method in which the gear was originally designed for its particular type of locomotive.

Many methods of setting valves are in use, commonly known as squaring valves, trailing valves and the like, but such methods do not always keep the locomotive from "limping"—a common name for an engine with valves which cut off unequally, such as two large exhausts and generally two small ones.

The average erecting shop man is accustomed to being shown instead of being told. As drawings are the universal language and speak for themselves, seven have been arranged to show clearly each operation in setting the valve to get equal lap and lead and equal cut-off; that is, the cut-off for which the gear was originally designed—say 25 per cent, more or less, according to whichever class of service the locomotive was designed for.

It is a well-known fact that no valve gear can be designed to give an equal cut-off in all its positions, due to angularity of main rod and eccentric rod. That is why it is best to set the valves with equal lap and lead and let the original cut-off design take care of itself, for the engineman does not adjust his reverse lever to any one set cut-off.

Setting Walschaert Valve Gear

Fig. 1 shows the Walschaert gear with a new main crank pin applied and Fig. 3 and Fig. 4 show how the crank is set, drilled, reamed and keyway cut at the machine shop drill press after the wheels have been removed from the wheel press.

Practically all back shops have blue prints of all their different classes of locomotives, but it is best not to rely entirely on blue prints as an occasion may occur at an outlying point, for example, that a strange locomotive is in for a new main crank pin and no blue prints available. Make a sketch on the laying-off table or on a piece of boiler steel or on any flat surface, as shown in Fig. 5, to actual size or to some convenient scale—say ¼ in. to the inch—using a pair of ordinary trammel points commonly used in laying off shoes and wedges. First scribe a circle C equal in diameter to the stroke of the piston, for example 32 in. Then draw a horizontal straight line which will be called the center line of motion. Measure from the center of the cylinder or piston rod to the center of the wheels and note if the cylinder is on the center line of motion, or if not, the distance above it. If above the center line of motion, draw a horizontal parallel line the proper distance above it. Next get the measurement of the main rod and scribe its length from the nearest point on the crank pin circle to the point D on the center line of the cylinder. Then draw a straight line from the point D to the center of the circle and the point E where it passes through the crank pin travel circle will be the dead center. Another way to obtain the point D is to add one-half the stroke of the cylinder to the length of the main rod and scribe an arc with this radius from the center of the crank pin circle. Next measure from the center of the pin in the bottom of the link, or link foot pin, to determine how far, if any, it extends above the center line of motion. When measuring, it is essential that the link be in the position shown in Fig. 1, known as "still valve position." If the link foot pin is above the center line of motion, scribe off a horizontal line F the measured distance above the center line of motion. Then set the trammel points to the length of the old eccentric rod, which is accurate enough for this dimension, and with one point at the center of the crank pin circle scribe the length on the link foot pin line and draw a straight

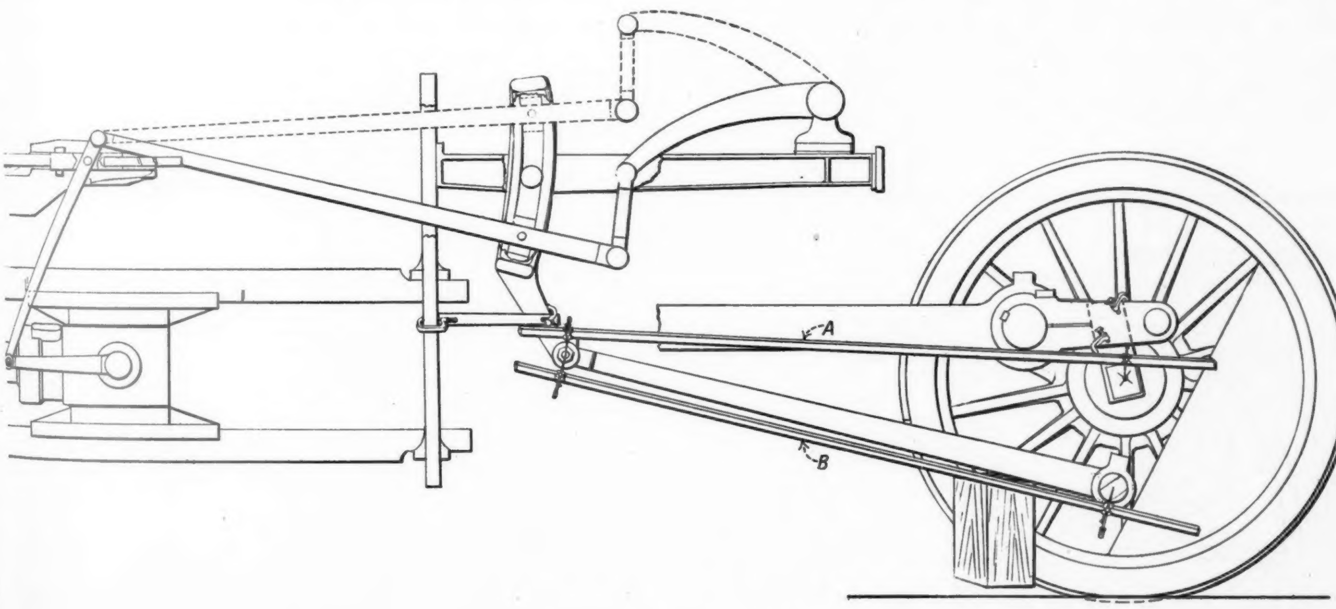
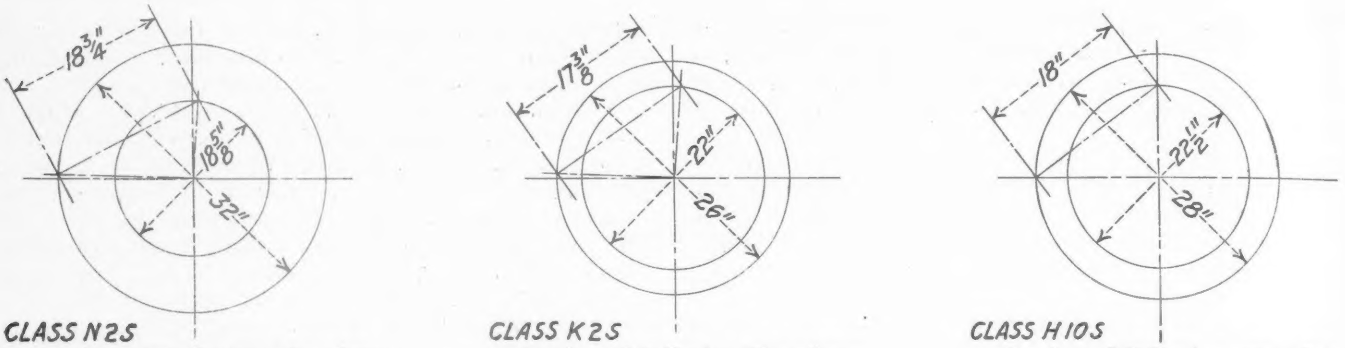


Fig. 1—Setting the Walschaert Valve Gear

*An article submitted in the Erecting Shop Competition and judged worthy of honorable mention.

line G through the two points as shown in Fig. 5. From the point where this line passes through the crank pin circle, measure the distance to the center line of motion and then scribe a line H located the same distance back of the quarter or perpendicular line through the same circle, with its other point through the center of the circle. Scribe the length of the crank arm from the point E, which is the intersection of in order to act as a proof line as shown in Fig. 4. The point where these two lines scribed on the sheet iron intersect should be directly out from the center of the wheel, as shown in Fig. 3. If not, knock the crank arm to this position and measure out with a square, as shown in Fig. 4. Try the square in all four positions from the wheel center, but before doing so the face on axle should be sand-papered clean.



CLASS N2S
Center of Cylinder 2 in. above Center Line of Motion. Center of Link Foot Pin 3½ in. above Center Line of Motion. Angularity of Eccentric Rod 9/16 in.

CLASS K2S
Center of Cylinder 2 in. above Center Line of Motion. Center of Link Foot Pin 4 in. above Center Line of Motion. Angularity of Eccentric Rod ¾ in.

CLASS H10S
Center of Cylinder and Link Foot on Center Line of Motion. Angularity of Eccentric Rod 25/32 in.

Fig. 2—Charts Giving Data Required for Laying-out Gears May Be Obtained from the Drawing Room

the center line of the main rod, with the crank pin circle through the last scribed line H. The distance measured from this last point I to the center of the crank pin circle will be the radius of the circle J in which the crank arm pin travels. Scribe this same dimension from the crank arm pin center, as shown in Fig. 4, to the piece of sheet iron clamped on the crank arm; also scribe as shown in the same The same method of setting crank arms is applicable also to the Baker, Southern and similar gears.

To get the next important dimension the still valve must be obtained and while obtaining the still valve other parts may be checked at the same time as shown in Fig. 1. Clamp the bottom arm on the link to some stationary point, the guide yoke, for example, and reverse the gear from forward to

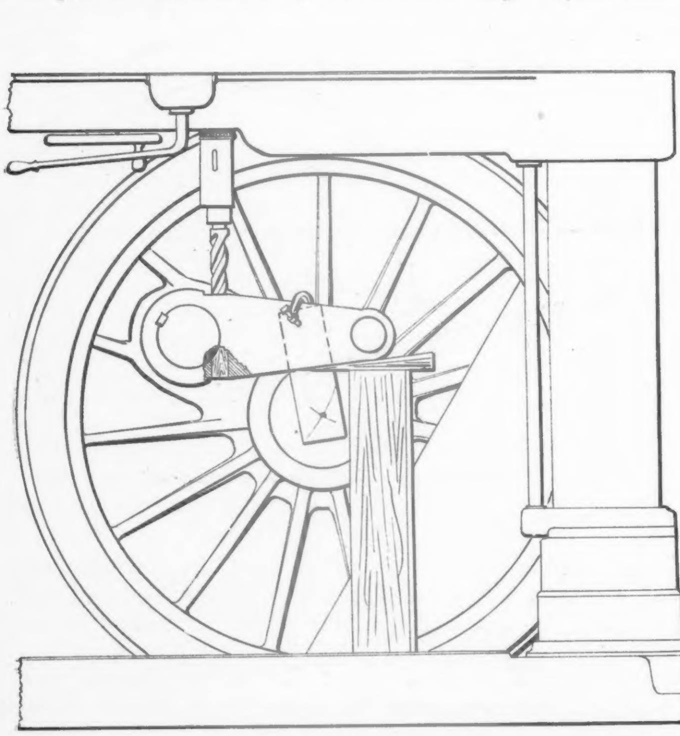


Fig. 3—Locating Crank Arm.

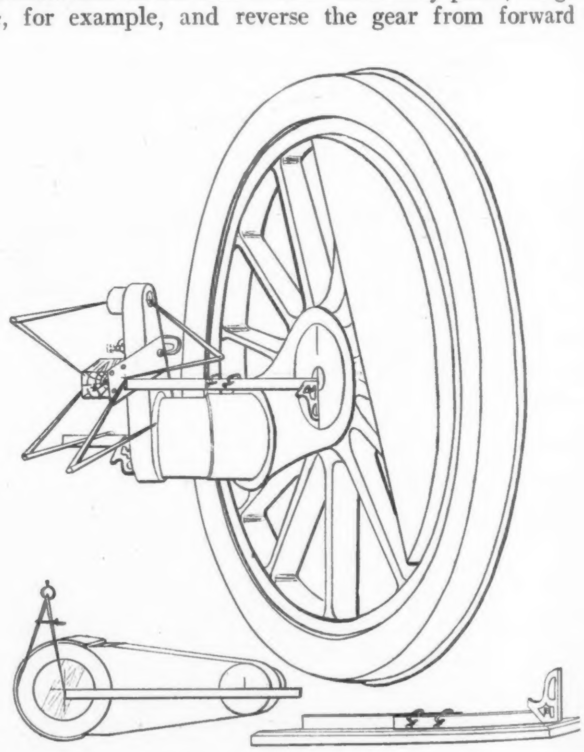


Fig. 4—Locating Centers

drawing one-half of the crank pin travel or stroke on the same piece of sheet iron. The average mechanic would say it is impractical to measure from the crank pin in the case of an old pin, as the tendency is to wear out of round, so before putting the crank arm on the pin scribe a circle around its outer edge, slightly larger than the diameter of crank pin, backward positions. Hold the valve rod tram on the rod to see that there be no motion of the rod. Should the rod move, shift and reclamp the link until it can be reversed without moving the valve. It is important while reversing that the crosshead be on either front or back end of its stroke; that is, the distance from the striking point to the clearance

line as shown in Fig. 1. With the link clamped in this position, move the crosshead from its forward to back position and scribe the valve rod again. The two points should be at an equal distance on both sides of the port opening marked as shown, but if not, shorten or lengthen as the case may be by applying or removing liners to the valve spool inside the chamber, if the valve rod is too close to shorten. In no case should the length of the radius rod be altered unless it is done to obtain a still valve, as previously described in order to have it the correct radius of the link. With the wheels under the locomotive and the crank arm in place—as shown in Figs. 1, 3 and 4—it will be seen that a small block is screwed to the sheet iron clamped to the crank arm in order to bring it out to the face of the eccentric crank arm pin. The center from the inside of the sheet is transferred to the outside of the block, as shown in Fig. 4. This is the exact center of the wheel. With the eccentric rod attached to the link foot, set the trammel points to the center of the pin in the bottom of the link foot and measure back to the center of the wheel scribed on the block. The way in which the trams are used is shown in Fig. 1. This is not the length of the eccentric rod but the base from which the length is obtained. Use the same manner of laying out as previously used and shown in Fig. 5. With the eccentric crank arm travel scribed as shown, scribe with trams from the center of the circle (actual size) to a point on the link foot center line. From this last scribed point reset the trammels to measure from this point to the top or bottom of the eccentric crank arm travel at the point where it is intersected by the line through the center of the circle, which is perpendicular to the eccentric rod line. Hold the front tram point in its place and scribe from top to bottom of this crank arm circle, starting and ending on the perpendicular line as shown. This set dimension will be the correct length of the eccentric rod, or one may measure from this radius line to the center of the circle and add this to the length of the trams *A* in Fig. 1, which will also give the exact length of the eccentric rod. With the valve lined up to get equal lead on each side of port opening marks, the cut-off will run at whatever percentage it was originally designed for. To determine if the valve travel will be equal on both sides of the locomotive, place both crossheads in the same position and swing the link backward and forward with the reverse lever in center, or move the reverse lever until there is no motion in the valve. Then try the other side; if the valve is not still when link is swinging, the radius rod hanger must be lengthened or shortened, as the case may be, in order to obtain a motionless valve on both sides with both crossheads in the same position.

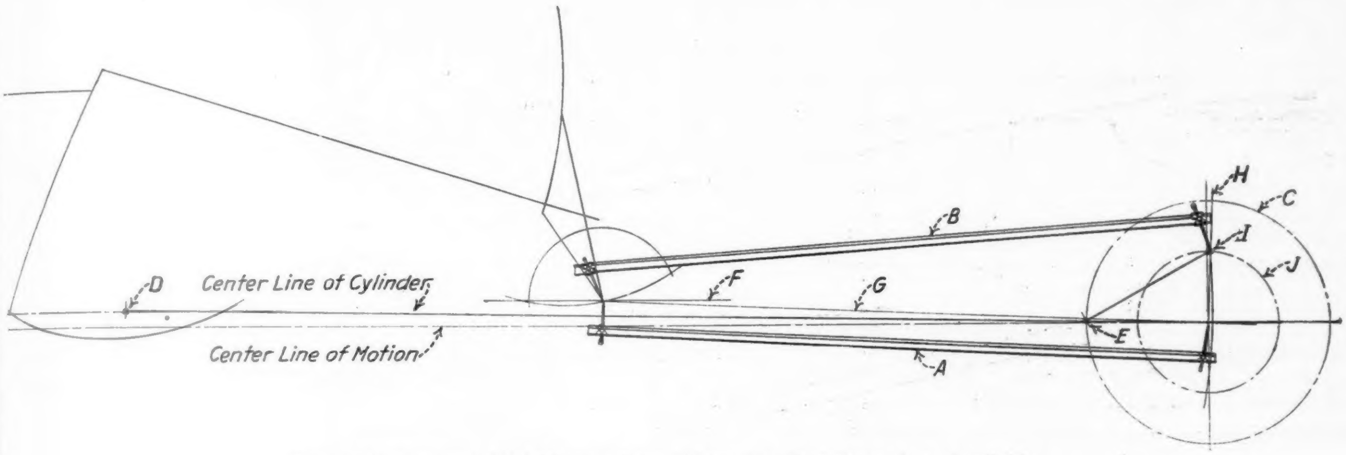


Fig. 5—Laying-out Walschaert Gear When No Drawings Are Available

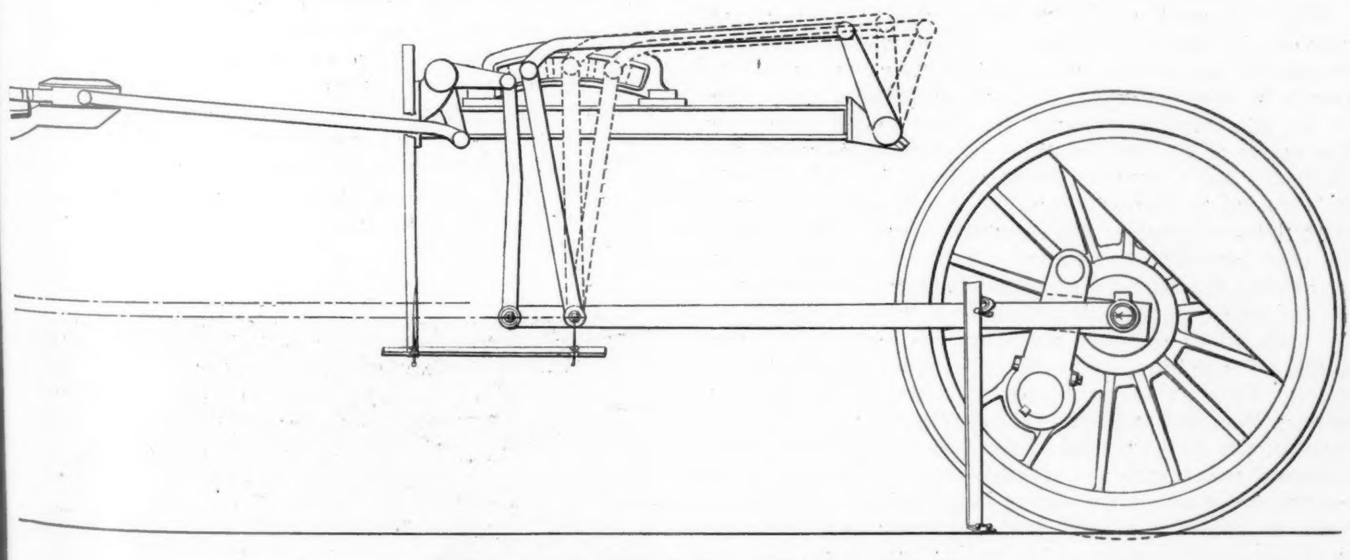


Fig. 6—Setting the Southern Valve Gear

If blue prints are available, no laying off will be necessary to obtain the different dimensions. A chart can then be made like Fig. 2 showing all the dimensions that are necessary to adjust the valve gears correctly. These may be obtained from the head draftsman as well as the angu-

larity of the eccentric rod for different classes, which is important.

Setting Baker Valve Gear

The instructions for setting the Baker valve gear are based on a ratio, as the reversing gear is standard for all types of locomotives. The method described for setting Walschaert extension, which is checked with blue print or by laying off. Equal travel on right and left sides may be obtained by adjusting the adjustable auxiliary reach rod on both sides.

Setting Young Valve Gear

Fig. 7 shows how the Young valve gear may be set correctly. Proceed as with the Walschaert gear until getting the

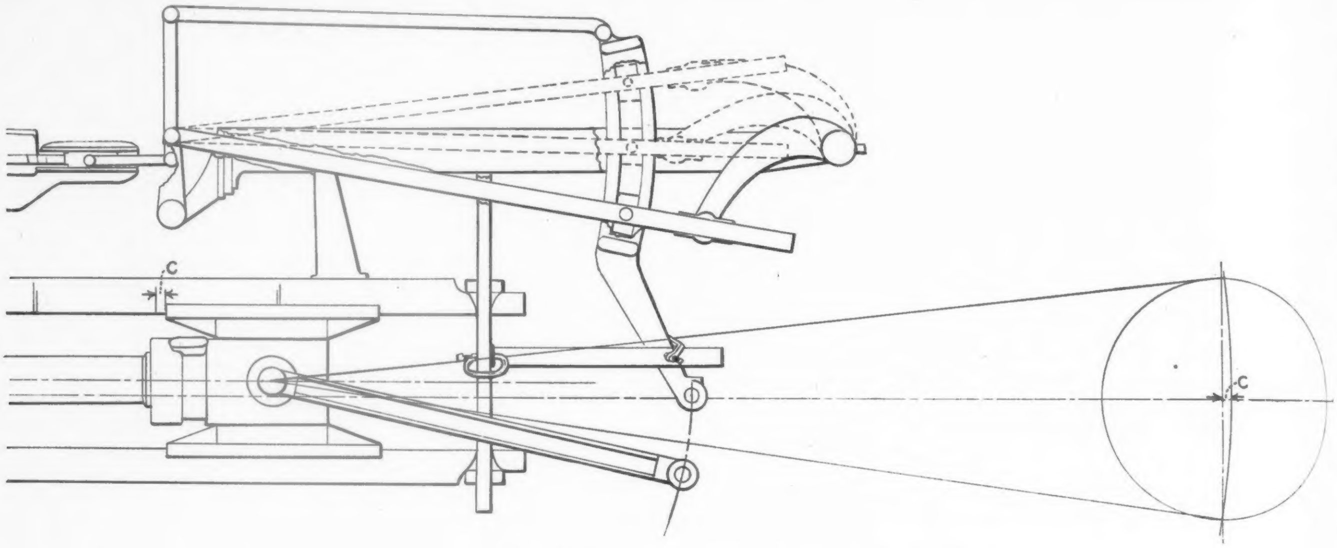
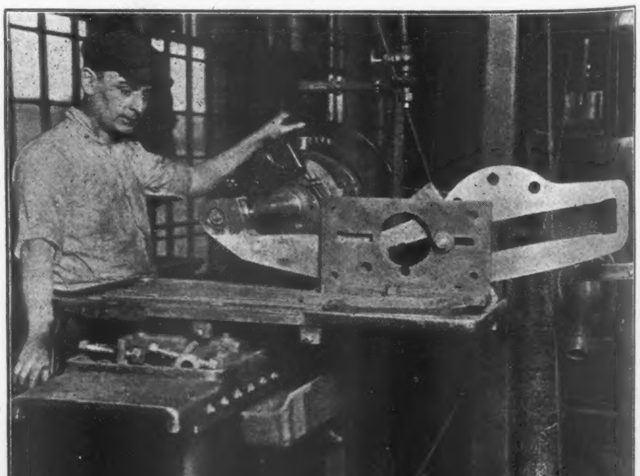


Fig. 7—Setting the Young Valve Gear

gear may also be used to set correctly and adjust the Baker gear. When doing so, no precaution need be used to have the crosshead in any one position when obtaining a still valve or when equalizing the valve travel on right and left sides of the engine.

Setting Southern Valve Gear

Fig. 6 shows how the Southern valve gear is adjusted correctly by the same principle. The center of the wheel is transferred out onto the sheet iron plate clamped to the crank arm in the usual manner. The gear is connected up as shown in the drawing and clamped to a bar spiked to the floor. The center of the back eccentric rod bushing is raised up to the center line as shown, or preferably 3/8 in. to 1/2 in. above the center of the wheel to allow for the drop of the locomotive when filled with water and in running order. Next, reverse the gear backward and forward until a still valve is found by moving the radius hanger rod backward or forward, as the case may require. When the still valve is found, with the back of the eccentric rod above the center of the wheel to allow for settling, scribe the valve rod with the valve rod trams. This scribe mark should be exactly in the center between the front and back port opening marks. Also tram from the pin in the bottom of the radius hanger rod to some stationary point, such as the guide yoke. This is to be used later in order to get the correct length of the eccentric rod. Next unclamp the eccentric rod and lower to the floor and move it and the bottom of the radius hanger rod pin until the tram points scribed on the guide yoke measure the same distance to the radius rod pin as before. This is known as the still valve. Hold the radius hanger rod in this position and measure from the bottom pin in the radius hanger rod to the center of the wheel and add the angular correction of the eccentric rod to this, which will be the correct length of the eccentric rod. The angular correction is obtained in the same manner as with the Walschaert gear. By the eccentric rod length we mean the distance from the bottom pin in the radius hanger rod back to the eccentric crank pin and the length in front of the radius rod will be called lap and lead length of the union link—the rod from the crosshead to the bottom link foot pin. To obtain this rod's length scribe on the guide, the center or middle of the crosshead's travel or center of the striking points and measure back the distance *C* from this center and scribe the angularity of the main rod. Place the crosshead in this last scribed position with the union link connected to it and with the link clamped in still valve position. The union link should then couple up to link foot pin. If it is not the right length, shorten or lengthen to suit. Should the difference be slight, 1/32 in. or so, the main rod can be lined to make up for it. The angularity of the main rod is found in the same manner as the angle of the eccentric rod, or as shown in Fig. 7. With the links in the still valve position on right and left sides, the valve rod tram should scribe a line in the middle or center of the space between the front and back port opening marks, as shown in the drawing.



Truing Hole in Link Foot on Planetary Internal Grinder

Standard Tool Gages*

By R. D. Fletcher

Owing to the fact that the average cost of locomotive repairs is about 70 per cent for labor and only 30 per cent for material, it behooves us to watch the time consumed in stripping, routing work through the machine shop and especially the time that is required to machine each particular piece of work. It is the writer's opinion that the machine side is one of the leading factors in railroad shop output, consequently more time should be devoted to supervision regarding the proper cuts, feeds and speeds required for the various classes of work to be done.

The average machine foreman is kept busy routing work and endeavoring to keep up with the erecting shop, and many times while doing this he overlooks individual operators. Frequently he does not know whether the proper cut, feed and speed are used so as to complete each job in the required length of time.

Machine Tool Demonstrator Aids Standardization

Each large shop should have a machine tool demonstrator to regulate the shape and size of tools, also the cut, feed and speed of each individual machine. This man should be in a position to know the ability of each operator as well as the class of work done on each machine. Standard tools are required somewhat like the ones used in large manufacturing plants today and all tools should be delivered to the tool room. One or more men can grind them and keep them always in good condition ready for service. The man in charge of the grinding should be furnished with a complete set of models and blueprints, giving the proper degree of rake, side slope and clearance required for the various kinds of work that each tool is designed to do.

Idle machines decrease shop output. To offset this, standard shaped tools for all classes of work should be on hand, and an ample supply ready for service. The machine operator can then replace a dull tool with the least possible loss of time.

Method of Grinding Highly Important

The grinding of tools is very important. "More tools are ruined in every machine shop through the overheating in grinding than from any other cause." There is a general idea prevalent that the heat generated in grinding does not affect the temper of high speed steel. This opinion is reached because cutting tools made of this material will stand up and maintain their cutting edge under a red heat which would render carbon tool steel useless. The fact is that high speed steel can be ruined as easily by grinding as the ordinary carbon tool steels. High speed tool steel is easily ruined by checks and cracks if great care is not observed. This is possible with both wet and dry grinding, but it occurs more frequently with dry grinding. Most operators cause their tools to check by pressing them against the grinding wheel hard enough to draw a color and occasionally dipping the tool in a pail of water. In wet grinding, the operator must remember that the presence of water alone is not a preventive to the burning, checking, or cracking of a tool. It is necessary to use the same ordinary care in the grinding of high speed tool steel that is observed in the every-day operation of the common machine tools.

More attention should be given to the loading and glazing of grinding wheels, causing the cutting or grinding surfaces to become smooth. No grinding can be done under these conditions and the additional pressure against the wheel only serves to increase the friction and generally ruins the tool. When ordering grinding wheels for high speed machine tools, it is very important to specify the proper grit, grade and bond; they should be kept true and running at 5,000 peripheral feed per minute.

Referring to the cuts, feeds and speeds of machine tools for regular shop practice, the data given later in the paper has been found very practical. Of course, there are times when it is up to the operator to increase or decrease the speed and feed of a machine according to the class of work that he is doing, but generally a heavy feed is worked to a greater advantage than a fast speed, especially on rough turning and planing. The shapes of tools, illustrated in Fig. 1, pertain to roughing tools only, and the angles used for the several classes of ordinary shop work are as follows: Cast iron, 8 deg. clearance, 3 deg. rake and 10 to 15 deg. side slope; soft steel, 8 deg. clearance, 8 deg. rake and 15 to 20 deg. side

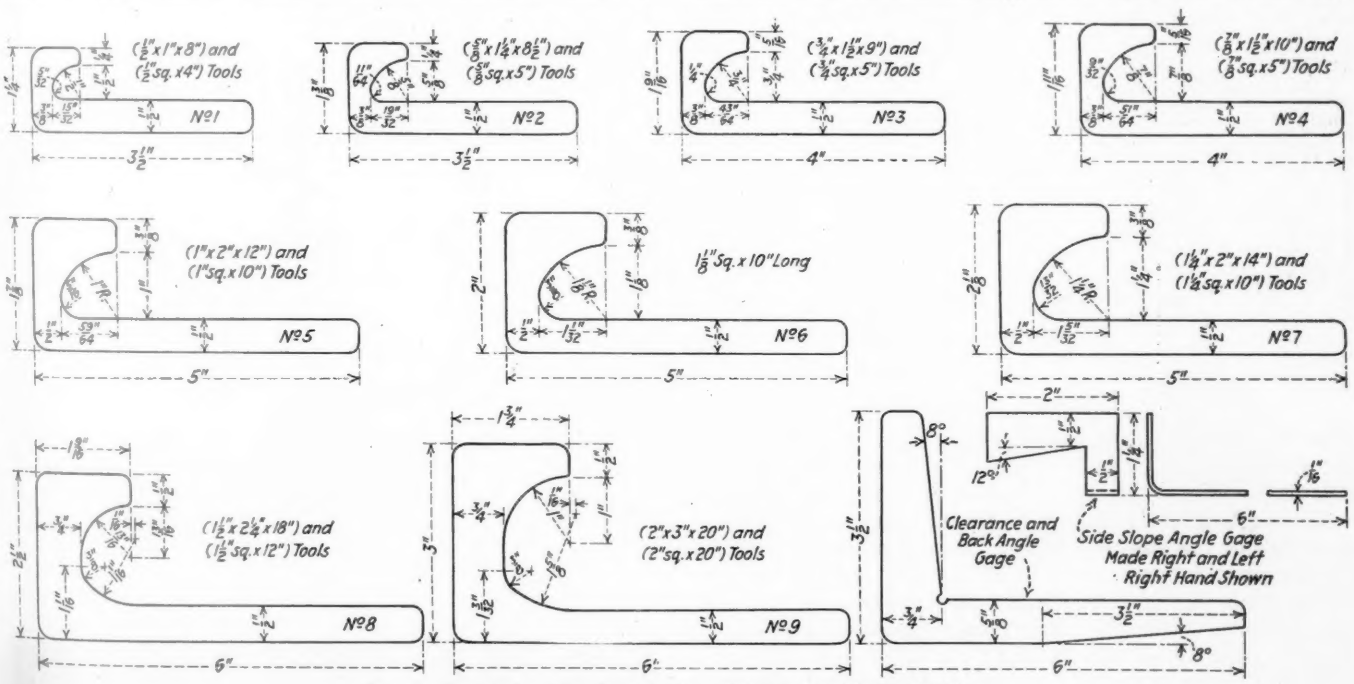
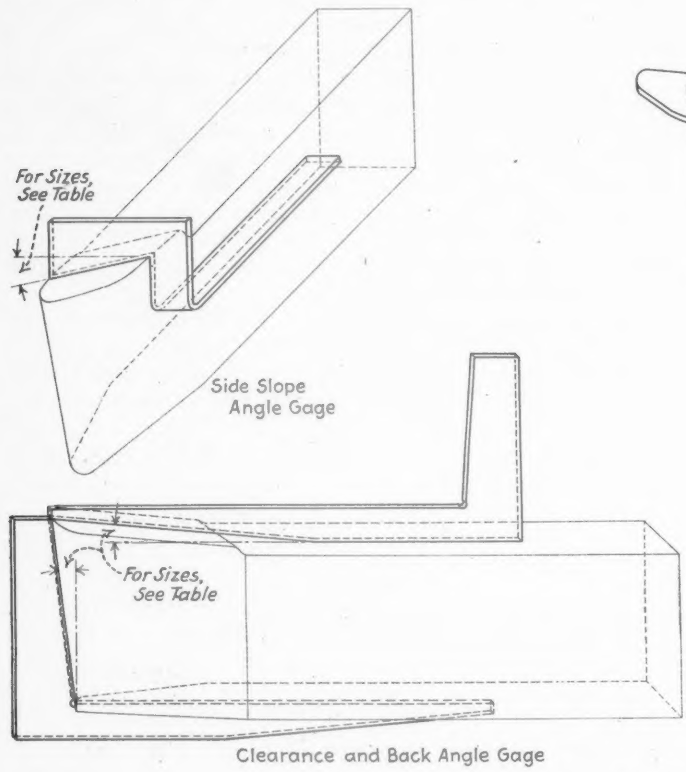
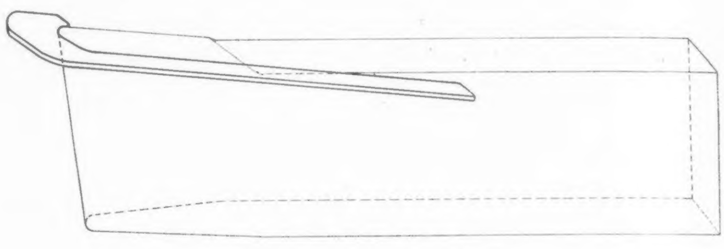


Fig. 1—Gages for Standard Lathe, Planer and Shaper Tools

*Abstract of a paper read before the 1923 Convention of the International Association of Railway Tool Foremen by R. D. Fletcher, retiring secretary. The gages described have been adopted as standard by some of the leading railroads, notably the Atchison, Topeka & Santa Fe. The author desires to give credit for much of the data presented to F. W. Taylor's book "The Art of Cutting Metal."

slope; tire steel on wheel lathes, 5 deg. clearance, 5 deg. rake and 5 to 10 deg. side slope. Planer and shaper tools require only 5 deg. clearance, while the rake and side slope remain the same as for turning tools. The side slope on these tools is greater than the rake, and the relatively steep side slope allows the tools to be more frequently ground without weakening. The chips also slide off in a line avoiding a tool post or holder. Moreover, the tendency of the tool to deflect to the side is largely corrected by throwing the pressure line within the base of the tool and reducing the feed pressure.





Materal to be Machined	Machine on which Tool is used	Clearance Angle	Back Angle	Side Slope Angle
Cast Iron	Lathes	8°	8°	10° to 15°
	Planers and Shapers	5°	8°	10° to 15°
Soft Steel	Lathes	8°	8°	15° to 20°
	Planers and Shapers	5°	8°	15° to 20°
Tire Steel	Lathes	5°	5°	5° to 9°

NOTE: When grinding never press tool against grinding wheel hard enough to draw a color on the tool as this will soften same and draw the temper.

Fig. 2—Method of Using Gages Shown in Fig. 1

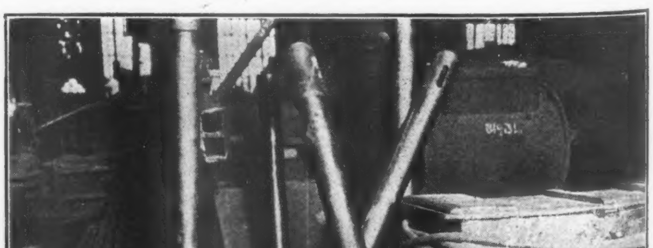
Gage No. 1 to No. 7, inclusive (Fig. 1) are for lathe, planer and shaper tools. Gage No. 8 and No. 9 are for wheel lathe tools only. Fig. 2 shows the method of using these gages.

All roughing tools should be forged and ground as near the width of the steel as possible thereby allowing a greater feed pressure against the side of the tool, greater strength for the chip pressure on the top of the tool and a greater area for heat radiation. The proper radius of the cutting edge for each size of tool is about one-third of the thickness of the tool. For example, a 3/4-in. by 1 1/2-in. tool would require a 1/4-in. radius for the cutting edge. To maintain this radius, grinding gages can be used to great advantage.

Data on Feeds and Speeds

With a 3/4-in. by 1 1/2-in. tool cutting soft steel, such as bolts and similar work, using a 1/16-in. cut and 1/16-in. feed, an average of 65 ft. per min. should be made. With a 1 1/4-in. by 2 1/4-in. tool turning crank pins, piston rods, axles and similar work, using a 1/8-in. cut and 3/16-in. feed, an average of 40 ft. per min. should be made. With a 1 1/4-in. square tool on a boring mill turning or boring gray iron castings, using a 1/8-in. cut and 3/16-in. feed, an average of 40 ft. per min. should be made. With a 1 1/2-in. by 2 1/2-in. tool planing cast iron or soft steel, using a 1/8-in. cut and 3/16-in. feed, an average of 35 ft. per min. should be made. With a 1 1/2-in. square tool, using a square nose for boring out tires with a 1/16-in. cut and 1/4-in. feed, an average of 20 ft. per min. should be made. With a 1 1/2-in. by 3-in. tool turning locomotive tires, with a 3/8-in. cut and 3/8-in. feed, an average of 13 ft. per min. should be made. For every additional 1/8-in. depth of cut used, reduce the speed about 15 per cent. Every shop has its own local conditions to meet and the above data is only a base from which to work, taking machine and shop conditions on the average.

The greatest amount of time is consumed in getting the work finished on the machine side, partly due to the fact that the machines are not properly grouped together. Insufficient crane service also often delays the work. In conclusion, it is the writer's opinion that more time and study should be given the machine side regarding the proper grouping of machines and work to avoid delay in machine output. Work can thereby be returned to the erecting shop in a shorter time and locomotive out of service time reduced.



Worn Piston Heads Reclaimed and Made as Good as New by Brazing

General Foremen's Convention at Chicago

Problems of Personnel Receive First Consideration—Address by Director General of Railroads

IT was both significant and encouraging to note the attention given to methods of training and securing the co-operation of shop employees at the seventeenth annual convention of the International Railway General Foremens' Association. This convention was held at the Hotel Sherman, Chicago, September 4 to 7, inclusive, and in view of the fact that business and labor conditions prevented holding a convention during the past two years the officers were much pleased with the attendance and interest shown.

President Wright's Address

In his opening address, J. B. Wright, president of the association, spoke in part as follows:

The International Railway General Foremen's Association will find its efforts valuable largely in the extent to which it can induce mechanical department supervisory officers to co-operate with officers in other branches of railroad service. We must feel our common responsibility in relation to the one thing that railroads have to sell—transportation. There is no doubt that our responsibilities are greater and our daily problems more complex than they were previous to the labor trouble of last year, and the fact that equipment in general on the majority of railroads is in better condition today than it was previous to the strike would indicate that these problems are being solved. I do not believe there is any one thing more important to the successful operation of the mechanical department of the railroads than that of proper and efficient supervision. In selecting subordinate supervisors, careful and serious consideration must be given to their ability. To be a successful foreman at the present time requires many qualifications which were given little consideration a few years ago. One of the most important of the general foremen's tasks is the proper training of subordinate foremen. Being responsible for the output and efficient operation of railroad repair shops requires a man capable of surmounting any obstacle no matter what it may be. Due to direct contact with employees, the foreman's attitude toward them must be such that he will not only gain but retain their absolute confidence. To the employees, the attitude of the company is reflected through the shop foremen and if foremen practice unfairness in dealing with them, the loyalty which is needed most on the railroads today will be lost. Fairness and firmness will win and hold the respect of most men we may come in contact with. The railway executives are asking for more mileage, and an improvement of the bad order cars and locomotive situation which necessitates speeding up in every department. Much has been accomplished along these lines by stirring up real enthusiasm throughout the entire railroad organization. The real problem now is to see that this enthusiasm does not die down but that every railroad employee is spurred on to greater activity.

Address by James C. Davis

On the second day of the convention an address was delivered by James C. Davis, Director-General of Railroads, on the subject of "the Responsibilities of American Citizenship," of which the following is an abstract:

The United States today has the most efficient rail transportation system in the world. Even at present rates, persons and commodities are transported for less compensation than in any other civilized country on the globe. This vast system has been largely constructed within the memory of many men and women now living. In 1870, five years after the close of the Civil War, there were some 50,000 miles of railroad in existence. Since that date, covering a period of a little more than fifty years, more than 200,000 miles of railroad with necessary equipments and terminals, have been constructed.

The money necessary to create this wonderful system has, all except for comparatively small donations by various states and national government, been furnished by private individuals, who invested their private funds in this great and necessary improvement, which has been the controlling factor in the country's growth and development. The value of this property, resulting from the construction of this vast plant, as fixed by the tribunal created by law, is now in excess of $19,000,000,000.

It is quite accurately estimated that the stock and bond holders of the American railroads aggregate over two million. It is a matter of note that small investors make up the great aggregate; investors who have ordinarily paid full value for their holdings, under laws recognizing such carrier obligations as private property. Persons who have purchased these

J. B. Wright (Hocking Valley)
President

G. H. Logan (C. & N. W.)
First Vice-President

H. E. Warner (N. Y. C.)
Second Vice-President

securities have a private ownership in them, just as a man has who owns a home, an automobile, or a farm, and so long as we have a constitution and courts to adminster the law of the land, this private ownership will be recognized and protected.

Every one concedes that an adequate system of transportation, highly maintained and efficiently operated, is absolutely essential to any sort of national prosperity and progress. Railroads cannot be efficiently operated unless their income is sufficient to pay operating expenses, fixed charges and a reasonable return on the investment. Men will not work unless their wages are paid; coal and materials must be paid for; capital will not invest unless promised a fair return. The income must be sufficient to pay these charges and to properly maintain the plant or the railroads cannot be operated as privately owned property and the only alternative will be public ownership and public operation.

The remedy proposed is to cut the value of the property in two, on the alleged theory that outstanding railroad stock represents eight or ten billion dollars of water. This charge is made without any sort of consideration of the undisputed facts and would destroy the entire value of all of the outstanding stock. It would violate every provision found in our national and state constitutions protecting the rights of private property.

T. J. Mullin (L. E. & W.)
Third Vice-President

C. A. Barnes (Belt Ry. of Chicago)
Fourth Vice-President

William Hall (C. & N. W.)
Secretary-Treasurer

If by an act of Congress or the legislature you can destroy one-half of the value of the railroads, why stop at one-half? Why not destroy it all? If you can reduce or destroy the value of railroad property owned by private individuals by a legislative act, why not apply the same rules to water, gas, electric light and street railway property, and thus reduce the charges which the public pay for these services? If this step is taken, by the same logic the government could either destroy the value or make a common ownership of farms, homes, factories and all sorts of tangible property. In none of these suggested cases from the railroads down can this be done so long as we have a government functioning under a constitution protected by courts that respect the rights of private property.

Before our present form of government is destroyed, should there not be presented a better and a definite plan as a substitute? Has not our existing form of government been a success? Is there a government or a land in the whole wide world where the people as a whole have such opportunities to enjoy life, where men can so effectively enjoy the fruits of their own labor, where advancement and promotion wait only on efficiency and industry?

Efficient transportation is essential to any sort of national prosperity and some degree of patience should be exercised to enable the carriers, under the existing detailed governmental supervision, to work out as nearly as possible an ideal transportation system.

Locomotive and Car Shop Efficiency

Competent and adequate supervision is a great factor in maintaining shop efficiency. A modern shop with up-to-date improved machinery and with an unlimited pay roll, if supervised by incompetent foremen, cannot compete with an old shop lacking in modern tools, but where the supervision is of the best. Competent supervision makes for competent workmen. A combination of executive and mechanical ability makes an ideal supervisor.

A good supervisor must be a student of human nature, quick to discern men's qualifications and capabilities, assigning men to that class of work to which they are best adapted. A competent supervisor will gain and hold the respect and confidence of his men by a firm but quiet insistence of the recognition and performance of rules of the shop and by his daily habits and actions.

Satisfied men are efficient men; therefore they should be made to feel that their efforts are appreciated. In handling men today and getting the output for your companies that can be reasonably expected, it means one of personal and close contact with the men themselves. Make that one of your important duties.

The grouping of machinery making for one continuous movement is a very great factor in the efficiency of the shop, and should receive due thought and deliberation. Every machine should be worked to its fullest capacity, and it is the duty of the supervisor to see that this is done. He therefore should be a competent judge of the machines' capabilities.

No supervisor should be expected to do work that a clerk can do; the cost is too high and the penalty paid too great. He should not be expected to leave his department to look up material from the store house.

The increasing demands made each year on the American railroads, due largely to maintenance requirements enlarging more rapidly than the shop facilities, bring the problems of increased output per man hour and costs into a prominent place in the affairs of railway shop supervisors.

Training and Developing Apprentices

Apprentice training on railroads in general was neglected to some extent during the war period but it is apparent to those who are familiar with the situation that interest is now being revived in this direction and that it is being recognized that the best hope of the future is to carry on a recruiting system that will provide the force of competent men which is necessary for successful results.

The apprentice training plan should provide for shop instructors who follow up the apprentice on the job to see that he is given instructions in the best methods of performing the work to which he has been assigned. The duties of the instructor are not supervisory but educational. He does not assign work but follows up the boy to see that he is moved in accordance with the established schedule of shop work for apprenticeship training.

The theory of shop practice has proved to be a more interesting subject to the average apprentice than the other classes of study. This is undoubtedly due to the fact that they can more readily see the direct application of the instruction to the shop work. Unit text books, each containing one shop practice subject, and questions pertaining thereto, should be provided for instruction during the first two years of the course.

The success of the apprentice school depends largely upon the energy and enthusiasm of the school instructor. Best results can be obtained if the school is in the charge of one who undertakes the job for the love of educational work and who is practical mechanic enough to demand the respect of the shopmen. He must possess the ability to find and touch the chord in the boy's nature that will stimulate enthusiasm for his studies when it is apparent that his interest is lagging. He must keep the instruction abreast with the shop work by incorporating new lessons as new equipment is adopted by the shops. This will require that he make frequent visits to the shop and keep in touch with latest shop methods. Ambitious apprentices, like all other enterprising railroad people, have a fondness for "digging into" new equipment.

The instructor should be aided in every way so that the enthusiasm in the courses can be kept up. He must be given assistance in the lecture work by men in the shops who have the ability to impart their experience to others. This has the effect of giving a practical touch to the school work and enlarges the circle of persons who are interested in the apprentices.

A good plan is to have the representatives of the various supply houses give the apprentices lectures along their line on their regular visits to the shops. This gives the apprentices the advantage of hearing an expert along any particular line.

Shop Supervisors and Employees

The man in charge of the shop must have a vision of what can be accomplished and not be satisfied with what was done last month or last year. In increasing the efficiency of shop supervisors and employees it is necessary to hold foremen's meetings periodically.

The foremen and employees should be encouraged in suggesting and being given an opportunity to try out new methods of doing work. All employees should be encouraged to take some mechanical paper that treats on their particular line of work so that they can keep posted on all improvements and developments that are brought out in other shops.

Mistakes or improper practices should be taken up with the departmental foremen, gang foremen and employees doing the work in such a manner that it will be considered as educational, for the betterment of the service and in no case should be let go without the proper investigation and each one concerned having his particular attention called to the mistake and the better way of taking care of the work in the future.

There should be close relationship between the shop and the store department and some sort of system inaugurated whereby the shop foreman will be notified within one hour of any material which it is impossible for the store department to deliver him on a written order. This is very essential in order that the foremen and employees are advised in the shortest possible time so that he may provide a substitute and not hold up the output.

Increased Output per Man Hour—Cost

The general foreman or superintendent of shops should make out a schedule of engines out of shop, taking into consideration the number of fire box sheets, flues, general and light repairs that will be required for the desired output for the month, and advise the master mechanic or superintendent of motive power the number of each class of repairs to book in. It is very essential that the shops be given the class of repairs asked for, as the output of locomotive repair shops has been held back more by not having the proper class of repairs booked in than any other one cause. In other words, you must get an *in put* to get an *out put*.

A schedule of pit days each class of power you will have to shop will require should be made up, taking into consideration the size of locomotives and any special design that may affect the time necessary to repair.

After determining the number of days an engine will be in the shop for any classified repair, there should be a schedule made and followed out by each department, showing the number of days they will have on the more important items.

One of the most helpful ways to get efficient work from supervisors is to keep them informed regarding what they are doing and what it is costing. This should be done by comparison with previous months and years and where possible with other points doing the same class of work. This also helps where the employees know what they are doing, as compared to past records, keeping up the feeling that they should try to beat the past record.

Shop output is regulated by the condition of machinery, crowded shops, cleanliness and comfort of workmen, systematic attention to education, special knowledge, experience, morality, temperance, tact, resources, reliance, foresight, memory, energy, initiative, persistence, promptness, accuracy, system, executive ability of employees and foremen.

Increased output can be obtained by seeing that ample and the correct kind of material is furnished. Facilities for doing the work are provided such as riveting machines, straightening and bending machines, punches, shears. Increased output can be obtained by closer supervision, head work, adequate tools, new devices and specializing on certain well defined jobs.

This report was signed for the part pertaining to locomotive shops by H. E. Warner (N. Y. C.), Wm. Hall (C. & N. W.), F. M. A'Hearn (B. & L. E.); for car shops by C. F. Baumann (C. & N. W.) and C. E. Strain (Hocking Valley).

Discussion

In discussing this report, G. H. Logan (C. & N. W.) said that the human element is the most important factor in shop output with which the general foreman has to deal. More or less general unrest in the ranks of labor throughout the country is manifest and the shop supervisors must change this attitude, if possible. Good results cannot be expected from antagonistic men and railroad general foremen should exercise every talent in interpreting the constructive policies of the railroad managements to the shop employees. M. R. Benson (M. C.), said that shop supervisors should give workmen a fair opportunity to hang up production records by providing (1) full information regarding work to be done, (2) comparative records with past production, (3) tools, jigs and special tools needed for the particular work in hand. In addition, a fine opportunity is presented to foremen to secure the co-operation of their men by listening carefully to all suggestions made by them and at least trying all ideas which have a fair chance of success.

Another member commented on the mistaken idea which some general foremen have that they ought to take cases requiring disciplinary action out of the hands of the gang foremen. Gang foremen should never be slighted, and, as long as they are foremen, should be allowed to run their gangs

without interference. The possibility of considerable increases in shop output through friendly rivalry of various departments or gangs was favorably commented on.

The discussion of shop efficiency also brought out some strong comments on the necessity of co-operating with the stores department in ordering material in advance of the need and preventing excessive investments in material which is either obsolete or infrequently used. Another point mentioned was the need of modern machinery in most railroad shops on account of high labor costs. Foremen should constantly question if present machine methods are most economical and satisfactory. Manufacturing methods are also needed in railroad shops to a greater extent than now employed, large economies being possible by making and assembling interchangeable parts in advance of shopping. This reduces the cost of manufacture and enables cars and locomotives to be returned to service more promptly.

Considerable time was given to a discussion of apprenticeship courses, J. W. Gibbons (A. T. & S. F.), answering questions regarding the Santa Fe practice and C. W. Cross (N. Y. C.) explaining New York Central methods of dealing with this important subject.*

Maintaining Valves and Valve Gears

After the valve gear is removed it is thoroughly cleaned, given a coat of whiting and a hammer test, in order to find any defects. It is then checked up to proper blue print lengths, in order to keep these parts standard, with the exception of blades, which are altered after valves are set to suit conditions.

When applying a new main axle on an engine with Stephenson link motion, the quarter lines are placed on the axle before removing it from the lathe centers; keyways milled; eccentrics and strap applied and completed before the engine is wheeled. We find this method a practical way which has proven very satisfactory. With the Walshaert gear we have solid gages which are used to locate the position of the eccentric crank.

Valve Ring Bushing Record

Engine 40 (B. & O.) made 200,000 miles with one set of piston valve rings and bushings and the bushings were worn just about 1/32 in. These bushings were made out of Hunt-Spiller gun iron.

We rebore valve bushings when worn out of round 1/16 in. and apply a new one when worn 3/16 in. larger than the original size.

In removing valve bushings from cylinders we use the following method: First burn them out with the carbon electrode or with the acetylene torch and at other times use the air hammer. I think one of the best ways to apply bushings in a cylinder is to heat the cylinder with a charcoal fire and make the bushings a snug fit in the cylinder and apply the cap screws. In this way it appears to be able to do away with the leaky or loose piston valve bushings.

One of the most serious causes for cut piston valve rings and bushings is the lack of lubrication. Should some of the railroads that are being troubled with this fault adopt the practice of having the engineer use a little more oil a considerable amount of savings will result.

The report was signed by F. J. Spangenberger (Ulster & Delaware) and W. C. Clugston (Baltimore & Ohio).

Discussion

Several of the members seriously questioned the advisability of allowing valve chamber bushings to run until they were 1/16 in. out of round. Also the practice of applying valve chamber bushings by heating the cylinders was disapproved. Several of the roads have limits of 1/32 in. wear out of round for valve chamber bushings and apply them by screw action, thus preventing any chance of cylinders cracking due to expansion and contraction strains bound to occur when cylinders heat and cool off.

The relation of adequate lubrication to valve ring and bushing life was strongly emphasized, the members advocating three pints of oil per 100 miles, depending on operating conditions and type of locomotive. There was some question as to the best point of application of the lubricant, quite a few members maintaining that the best results are secured when oil is delivered to the valve chamber only and not to both valve chamber and cylinder, as is the practice on some roads.

*Both the Santa Fe and New York Central systems of apprentice training are commented on at some length in an article beginning on page 497 of the July, 1923, *Railway Mechanical Engineer*.

Repairing and Maintaining Duplex Stokers

Duplex stokers used on the Grand Trunk Western are removed every time the engine comes to the shop for class three repairs, taken to the repair department, and tested. Thorough repairs are made at a cost as shown in the following table:

APPROXIMATE COST OF REPAIRING STOKER

	Hr.	Min.	Rate
Stripping conveyor reverse unit	2	30	.34½
Welding body on main drive shaft	3	..	.77
Turning after weld	1	30	.70
Grinding	..	15	.70
Bushing conveyor pawl casing cover	1	..	.70
Fitting up conveyor reverse unit	2	..	.70
Welding pawl shifter	..	30	.77
Turning after weld	..	30	.70
Fitting sealing ring caps in hopper	1	..	.70
Stripping elevator screws and shafts	2	..	1.04½
Turning elevator screws for weld	2	..	.34½
Turning sleeves	..	30	.34½
Welding sleeves	3	..	.77
Turning after weld	3	..	.70
Fitting and laying off sealing ring caps	1	..	.70
Drilling and tapping elevator screws	2	..	.70
Fitting sealing caps on screws	1	30	.70
Applying new gears on elevator shafts	1	..	1.04½
Electric weld elevator shafts	2	..	.77
Turn after weld	2	..	.34½
Applying shaft screws and head on elevator	4	..	1.04½
Stripping and repairing main cylinder head	5	..	.70
Electric weld main drive rack	..	30	.77
Plane after weld	1	..	.70
Grinding piston rod	..	30	.70
Electric weld piston rod when loose	..	30	.77
Turn and thread	1	..	.70
Bore packing	..	15	.70
Slotting front drive rack	..	30	.70
Fitting up piston and rack	1	30	.70
Fitting up cylinder, applying rack and piston to hopper	4	..	.70
Repairing distributor tubes	1	..	.70
Bushing universal joint	1	..	.70
Bushing universal slip joint	1	..	.70
Testing stoker	2	..	.70

Fire Doors

Firing a locomotive with air fire door, requires with each scoop of coal, 10 less body movements than are required with a hand fire door. This is because reaching for the chain on a hand door leaves the body in an awkward, unnatural position for shoveling. With air fire doors, all a fireman has to do is shovel. Each ton of coal averages 115 scoopfulls. Ten tons are used on an average run, or 1,150 scoopfulls. The air door saves 11,500 body movements on an average run.

Accidents are prevented through automatic closing of the fire door. Burst flues cannot injure the man in the cab. The force of the explosion is directed through the grates and front end, instead of into the cab.

This report was signed by W. S. Buntain (Grand Trunk).

Railroad Shop Kinks

Micrometer Tire Gage

A gage designed to simplify the method of determining the correct thickness of shims necessary to use in setting of tires to conform to M. M. standard shrinkage allowance is shown in Fig. 1.

The body of the tool has its periphery marked with 125 graduations and as the hub is tapped eight threads to the inch, one graduation indicates .001.

The indicator which screws into the hub of the body must point at lines marked "125 and 250" when screwed up to the shoulder in the body.

As many shrinkage allowance shims should be made as is necessary to care for variations in driving wheel diameters. Adjustment is now made by screwing out the indicator until the gage is set with the indicator point at .070 and therefore it will be necessary to use a shim of ½ this thickness or a shim .035 thick which would be No. 20 gage.

Reference to developed view of graduations on drawing show the various gages of iron stamped in line with graduations which indicate twice the thickness of the various gages in thousandths. This is necessary by reason of the shim going entirely around the wheel center and it must of course be only one-half the thickness of thousandths indicated.

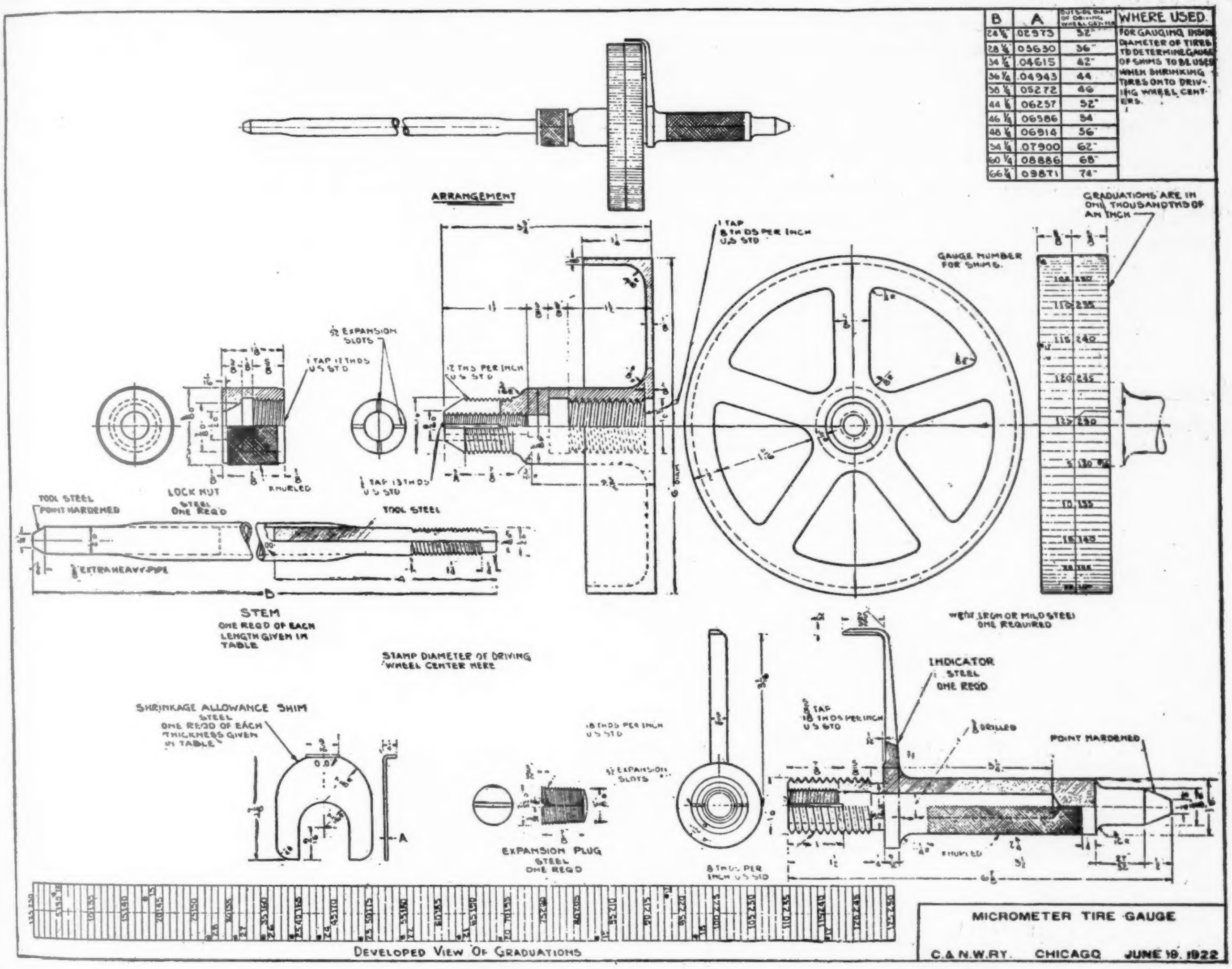


Fig. 1—Tire Gage for Determining Correct Shim Thickness Needed in Setting Tires

The method of using the gage is as follows, assuming the wheels on which the tires are to be set are 68 in. in diameter:

Caliper the wheel center; then assemble the tire gage with the stem marked "68" and insert the shrinkage allowance shim marked "68" between the shoulder on the indicator and the top of the body and screw the indicator down on the shim. If the shim has been properly made, the indicator point will show at .088 which is the M. M. shrinkage allowance for 68 in. wheel centers as shown on the chart under figure "A," and opposite the wheel diameter 68 in. The tire gage is then set to the calipers as in ordinary practice, adjustment being made by screwing the stem in or out, and when properly set, the stem is locked by tightening the knurled lock nut. The gage is then set to the exact diameter of the wheel center. Now screw off the indicator enough to remove the allowance shim and then screw the indicator tight to the body again and in doing this, you have made the gage .088 smaller than the wheel center. Then try the gage in the tire which is to be applied and we will assume it slips in or that the tire is larger than the gage. Adjust-

It can now be seen that if a man setting tires can caliper and will apply proper allowance shim to gage and remove it as instructed, when the tire is gaged the indicator will show the gage number of the shim he must use.

In connection with this tool, a standard wire gage should be used to insure the correct size of shim indicated being applied.

Lathe Dog or Driver for Crosshead Pins

This tool, illustrated in Fig. 2, was designed to eliminate the necessity of removing a tail or screw dog from the wrist pin each time it was necessary to try the pin in the crosshead. It is merely a block of iron tongued to fit a slot in the face plate of suitable height to go between the head of the pin when on a live lathe center and face plate, with a pin in hole and spring back of pin to allow for variation in size of center holes in wrist pins.

To use the device, it is necessary to drill a hole in the head

of the wrist pin slightly larger than the driving pin and these holes should be drilled at the same radius from the center on all pins.

The driver is set on the face plate so that the pin engages a hole in the head of the wrist pin and its advantage over a dog which must be removed is quite evident. In addition it permits a lathe hand to machine a pin in a handier way. With the old method of dog on screw or small end of pin the operator really works backward. With a smaller tool of this kind, rod knuckle pins and other headless two-fit taper pins may be more quickly machined.

The tool can be simplified by the elimination of dowel and grooves for driving pin, as a slight shoulder on the pin and an enlarged opening for the spring would be a better and cheaper way to make it.

Turning Ball Crank Pin Bushings

This device, shown in Fig. 3, can be used on any lathe that has a compound carriage attached. The center of the bottom of compound carriage must be in the center of lathe in line with the lathe centers. The carriage is reversed so that the feed handle on the compound carriage is at the back of the lathe instead of at the front. An arm is clamped to the tail stock spindle; also a connecting arm is attached from the arm on the tail stock spindle to compound carriage. These arms can be of any size or length to suit the condition and size of lathe. The ball bushing is held by means of a mandrel screw on the spindle of the lathe and held by a nut. The bushing is turned and the contour made by feeding the tail stock-spindle. After the first bushing is turned to size a gage should be made to set the tool by so that all bushings should be the same size.

This report was signed by G. H. Logan (C. & N. W.), M. J. Fahey (N. Y., N. H. & H.), J. M. Horn (M. & S. L.) and B. F. Harris.

Welding Driving Tire Flanges

On the subject of welding flanges on driving tires, we are advised that the restoring of worn flanges to their original thickness and contour is being successfully accomplished on some of the railroads of the country by both the electric and acetylene (gas) processes. On one of the important systems the following report is furnished your committee: For electric welding, a 3/16-in. coated carbon steel wire of 60 to 75 point carbon content is employed as an electrode to obtain a degree of hardness as near that of the original tire as possible, consistent with safety from failure. In application the initial metal is applied, starting on one side of the tire at a point corresponding with the horizontal center line and welding in an upward direction to the center line at the top. This is then repeated by starting on the opposite side and welding upward to the top, finishing half of the wheel, after which the engine is moved to allow finishing the opposite half in the same manner.

In starting, an initial deposit on the shoulder is formed by moving the electrode back and forth across the flange, in this way applying a triangular sloped deposit in one layer. The cost of building up a 63-in. tire under shop conditions is approximately as follows:

18 lb. welding wire @ 15 cents a lb.	$2.70
45 kw. hours power @ 2 cents a kw. hour	.90
6 hours labor @ 75 cents an hour	4.50
Total	$8.10

The cost will vary slightly depending upon size of tire, skill of operator, amount of material, etc., but this figure will represent average conditions.

We have also built up tires with acetylene. This makes a smoother job as we do not finish these tires off on a machine

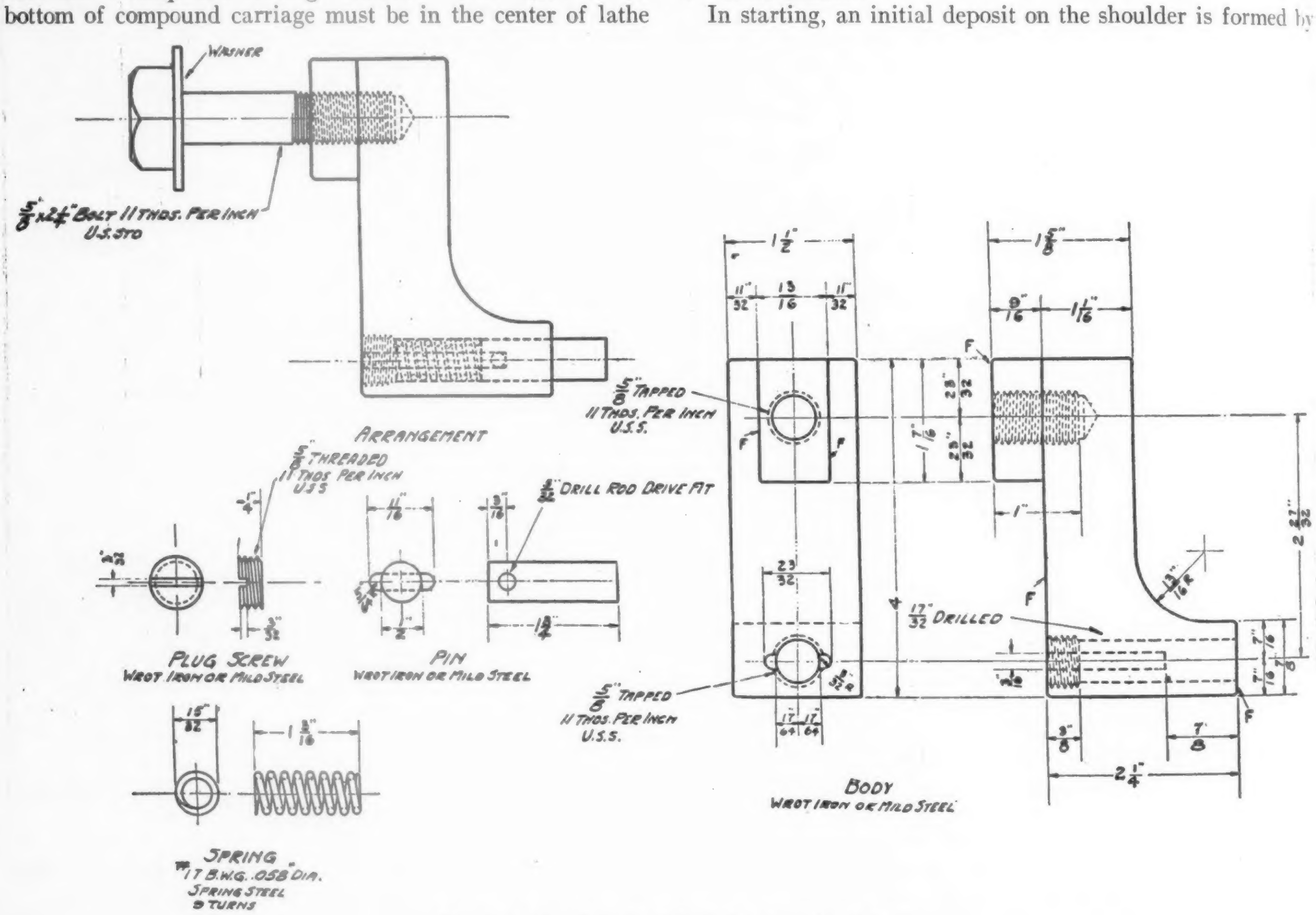


Fig. 2—Lathe Dog or Driver for Crosshead Pins

after they are built up, but the acetylene job costs more, due to the price of the acetylene and oxygen used. Gas for welding a 63-in. tire averages around $9.00 a tire. Labor and material used is practically the same for both gas and electric but there is a difference in favor of the electric welding of about $8.00 per tire.

Advice from another road is to the effect that on engines with 72-in. wheel centers, the welder with the oxy-acetylene process takes from 6 to 7 hours to complete one tire, using,

10 to 15 lb. of steel at 27 cents a lb.	$2.70
425 cu. ft. of oxygen @ $1.78 a 100 ft.	7.56
400 cu ft. of acetylene @ $2.60 a 100 ft.	10.40
Total	$20.66

An equivalent for 63-in. tire would be $16.80.

We have no data giving the relative life of flanges built up with the two processes except the statement that when flanges are built up by oxy-acetylene process they give a longer life than the original. The apparent greater cost of the gas process may be materially reduced when the life is taken into consideration.

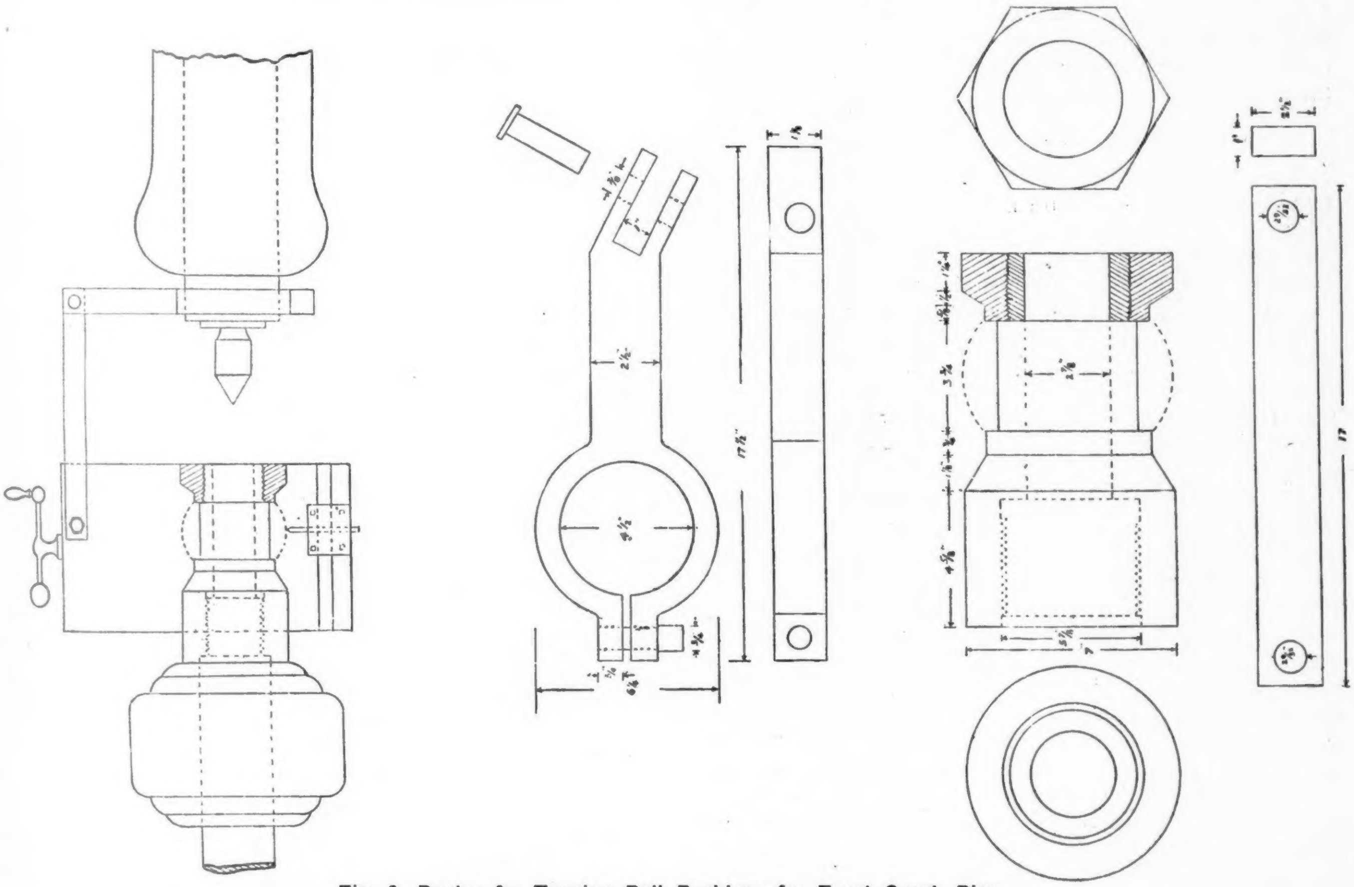


Fig. 3—Device for Turning Ball Bushings for Front Crank Pins

Taking the cost of building up tires by the cheaper of the two processes, you will note that you may effect a considerable saving in the cost of tire maintenance, and a rough estimate of a greater mileage between tire turnings. The life of tire will be increased from 1/3 to ½ on the initial cost.

Your committee is therefore of the opinion that the railroads should give this practice very careful consideration as a source of economical operation.

This report was signed by H. T. Cromwell (B. & O.).

Discussion of Sharp Flanges

F. M. A'Hearn (B. & L. E.) stated in connection with this subject that the best practice is to anticipate the cause of sharp flanges rather than attempt to "lock the stable door after the horse has been stolen." J. M. Ho[illegible] (M. & S. L.) said that from his experience it was dangerous to attempt to build up sharp driving wheel flanges by welding without removing the tires from the wheel centers, owing to internal stresses set up and the resultant danger of loosening and breaking tires in service. The members of the association were almost equally divided as to the advisability of building up sharp tires by welding. A large number of roads have had success with this method over a period of years and almost as many more roads have strict rules against any welding on tires. Several roads follow the practice of welding tires on switchers and slow freight locomotives, removing these tires for the welding operation and subsequently reapplying them. These roads do not weld tires on locomotives in fast passenger and freight service, however.

There was an extensive discussion of the best methods of preventing sharp flanges with particular emphasis on the need of squaring the frames properly and laying out the driving boxes, shoes and wedges so that the one wheel will not be ahead of the other. Improper spring equalization also sometimes causes cutting on the front driving wheels and the same result is caused by engine trucks and trailer trucks not being properly centered.

Election of Officers

The following officers were elected for the ensuing year: President, G. H. Logan (Chicago & North Western); first vice-president, H. E. Warner (New York Central); second vice-president, C. A. Barnes (Belt Railway of Chicago); third vice-president, B. L. Davis (Chesapeake & Ohio); fourth vice-president, F. M. A'Hearn (Bessemer & Lake Erie); secretary-treasurer, William Hall (Chicago & North Western). The following were elected members of the Executive Committee: C. F. Baumann (Chicago & North Western), M. H. Westbrook (Grand Trunk), M. R. Benson (Michigan Central), William Mulcahy (Baltimore & Ohio), and W. F. Lauer (Chesapeake & Ohio).

Progressive Repair System for Locomotive Shops

The Straight Line Method Used in Modern Industrial Plants Applied to Classified Repairs

By Lawrence Richardson
The Whiting Corporation

"STRAIGHT LINE" methods of production, the foundation of all successful low-cost manufacturing, have recently been applied to heavy freight car repairs with gratifying results. These installations have shown marked savings, at least one of them passing the half-million mark annually. Their success has suggested the further application of the same principles to classified locomotive repairs. With an annual back shop repair bill for labor alone of more than $125,000,000, it will readily be appreciated that even a small percentage of saving will warrant their adoption.

Usual Shop Procedure Not Economical

When a locomotive is taken in a back shop for classified repairs the usual procedure is to place it on a certain track, where it remains until the repairs are completed. This means that all parts removed for repairs must be cleaned, usually including a trip to the lye vats, and trucked to their respective repair points. After being repaired, they are trucked back to the locomotive for assembly. Some of the larger back shops use two or three gangs on this trucking. Since all repair jobs start and end at a particular locomotive, the path traced by any particular part is a closed loop. "Back-tracks" are common. This counter-movement always means a loss in productive effort, and gives rise to confusion.

To minimize this trucking and overlapping movement a "Straight Line" system of back shop operation has been devised. With this system all movements are continuous and onward, with no conflicting or backward movements. The principal feature of this system is the division of the repair work into stages. The locomotive is received at one end of a shop, where it is unwheeled on a hoist. The wheels, boxes, valve motion parts, rods, etc., are removed, cleaned and started moving in "Straight Line" through the repairs to the final stage. The locomotive is then placed on trucks and moved to an intermediate track, where the repairs are continued. When the locomotive is ready for wheeling, it is moved to the far end of the shop and wheeled on a second hoist. The rods, wheels, boxes and valve parts meet it at this point. The repairs are completed here, all of the movements leading to this point without any crossing or retracing.

Straight Line Shop Layout Simplifies Movements

An application of the straight line principles to a locomotive repair shop is shown in Fig. 1. The arrows on the "IN" and "OUT" tracks and on the transfer table denote the movements of the locomotive proper, while other lines denote the movements of wheels, boxes, rods and valve gear parts.

The locomotive enters the shop at the point "IN" and passes through the stripping and unwheeling operations. The wheels are moved out of the shop and first pass the tire heating pits, where the necessary tire changes and renewals are made. If the locomotive is in for firebox or heavy boiler repairs, its wheels are moved to the wheel storage to prevent congestion; at the proper time, they are again placed in line so as to meet the locomotive when it is ready for wheeling. In this second stage, they move past the wheel and journal truing lathes onto the track leading to the wheeling jack. This track is so arranged that the machine bay crane can transfer the wheels to the hoist track. As there is space for 15 drivers under this crane, variations in the outbound schedule can be handled. A locomotive can be moved ahead or back without appreciably affecting the system of operation.

Meanwhile, the rods, valves, boxes and other parts are moved to the lye vats or to the sand-blast room. After cleaning, the parts move over a small industrial railway just outside the shop wall, the valves, rods and boxes being distributed as shown by the arrows.

Machine Shop Divisions

In the "box" area are located a press, lathe, boring mill and planer. It will be noted that the "box" area lies in the angle made by the wheel movement. This permits the boxes to be swung onto the wheels as they pass.

The "rod" area is located immediately adjacent to the position occupied by the locomotive after moving off the wheeling jacks. The average movement of the rods from bench to locomotive is only 28 ft. No time or effort is wasted in moving them about the shop, as the work is always done at the same station. Gooseneck cranes are utilized in hanging rods, thus releasing the overhead crane for other service.

The "valve" area is located to give an average movement of 97 ft. from the bench to the locomotive. In the case of Stephenson links and other inside hung valve gear requiring assembly before wheeling, this space is centrally located with respect to the tracks in the main bay of the erecting shop. The average distance to the erecting shop tracks is only 195 ft.

The rest of the machinery is grouped to the best advantage. The heavy repairs are concentrated in the far end of the erecting shop, the large machines usually involved in this work being placed adjacent this area.

Separate Hoists for Unwheeling and Wheeling

After the locomotive is stripped, it is moved onto the hoist and unwheeled. It may then be moved to a final stripping pit. This pit is only used as a relief, as the regular organization ordinarily should finish the stripping on the first pit. After stripping and unwheeling, the locomotive is moved on trucks onto the transfer table and shifted to a track in the main bay of the erecting shop. The variation in the time required for repairs is taken care of here, the time depending on the class of repairs. Class 5 repairs should move through the main bay in a day.

When ready for wheeling, the locomotive is again transferred. not back to the "IN" track, but onward to the far end of the shop, where it is wheeled on a wheeling hoist and is then moved onward. The rods are hung, the valves set and the locomotive turned out as shown on the diagram. A number of outbound stages may be consolidated.

Advantages

The principal advantages of this system are the elimination of expensive overhead heavy-duty cranes and the utilization of lower buildings of much lighter construction, thus materially decreasing the investment and reducing the direct labor charges.

The layout shown is an adaptation of this scheme, and can be modified to meet existing shops and property limitations with no essential change.

Shops may be built as outlined in the sketch between the "IN" and "OUT" tracks, inclusive, this distance being a minimum for efficient handling. As more facilities are demanded, the heavy repair bay can be added without changing the system of operation.

Comparative Capital Investment

The accompanying figures are based on a transverse erecting shop served by a transfer table, as shown in Fig. 1, which is a typical layout, representative of American back-shops. The usual equipment today would be a 200-ton crane, with a 10-ton crane operating on a lower runway.

With "Straight Line" operation, the unwheeling is done by a hoist at one end of the shop and the wheeling by a second hoist at the other end of the shop. The locomotives are handled from stage to stage on trucks. Necessary lifting in the main bay of the erecting shop is handled by a 10-ton crane.

Equipment for 20-Track Shop

EQUIPMENT FOR 20-TRACK SHOP

Present Operation		"Straight Line" Operation	
Cranes, 1-200 ton..........	$45,000	2 200-ton hoists	$24,000
Cranes, 4-10 ton...........	28,000	4 10-ton cranes	28,000
Transfer table, 1-250 tons..	12,000	40 trucks @ $400 each.....	16,000
Extra cost of crane runway @ $200 per ft...........	88,000	1 250-ton table	12,000
	$173,000		$80,000

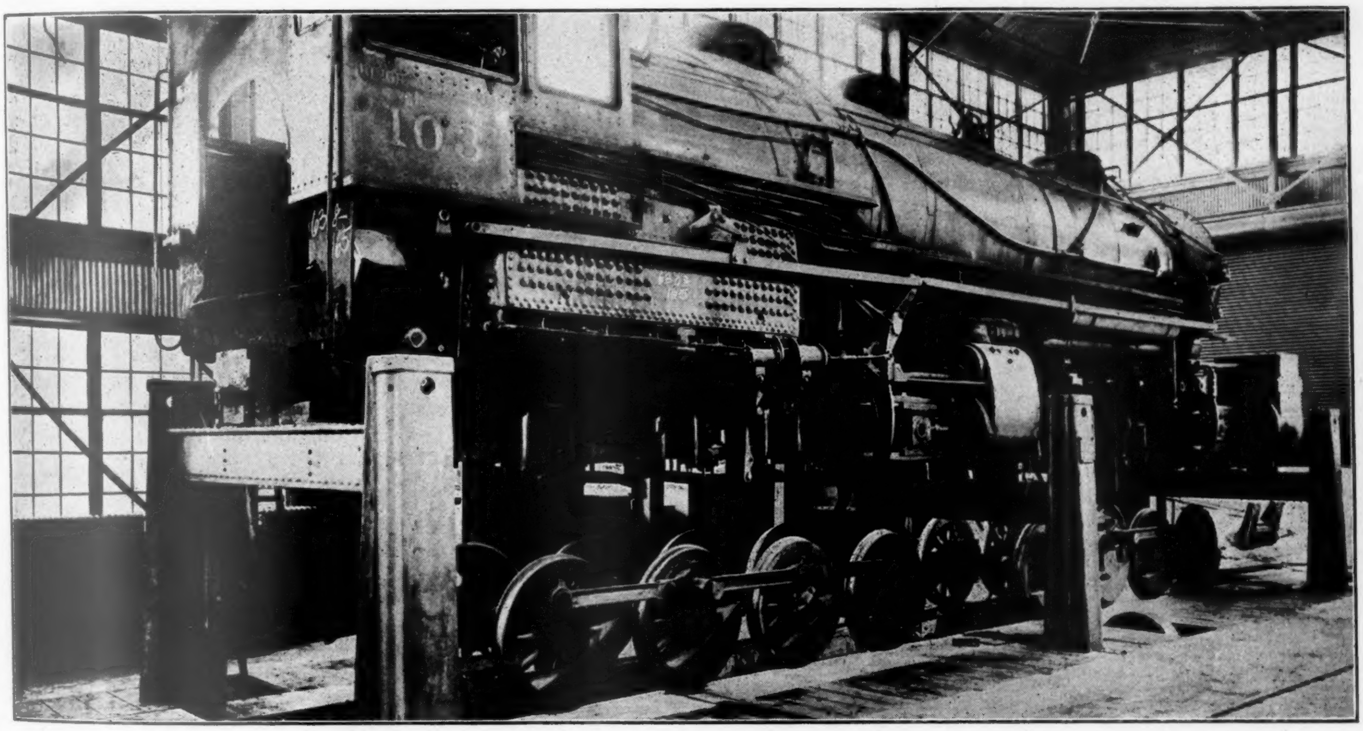
Saving in favor of "Straight Line"...........................		$93,000
Interest, depreciation, taxes and repairs @ 10 per cent, Present Operation	$17,300	
Interest, depreciation, taxes and repairs @ 10 per cent, "Straight Line" Operation..................	8,000	
Saving per year in fixed charges in favor of "Straight Line".......		$9,300
Additional cost of transferring locomotives in "Straight Line" system		900
Net saving per year (exclusive of direct labor)....................		$8,400

In this estimate, a transfer table has been charged against the present type of back shop. The carrying charge, however, is small compared with the advantages gained. This was strikingly brought out on a recent visit to a shop not so equipped. The heavy overhead crane was out of service for some 30 days, completely tying up repair operations. Had the shop been equipped with a transfer table, they would have managed to operate with but a slight inconvenience. The loss in production exceeded $100,000.

It will be further noted that no allowance has been made in the statement for the additional maintenance and operating cost of the heavy overhead cranes. This is an appreciable item and will make the net saving even more attractive.

Straight Line Operation Used for Car Repairs

"Straight Line" operation has recently been put into effect at the Beech Grove car shops of the C. C. C. & St. L. The cars are moved from one end of the shop layout to the other by stages; stripping, fitting, riveting, brakes and safety appliances, inspection and painting following in the order named. The outstanding result was an increase in the daily output of heavy repairs from six to 15 cars per day. A similar system has been put in effect at the Readville shops on the N. Y., N. H. & H., which was described in the August issue of the *Railway Mechanical Engineer.*

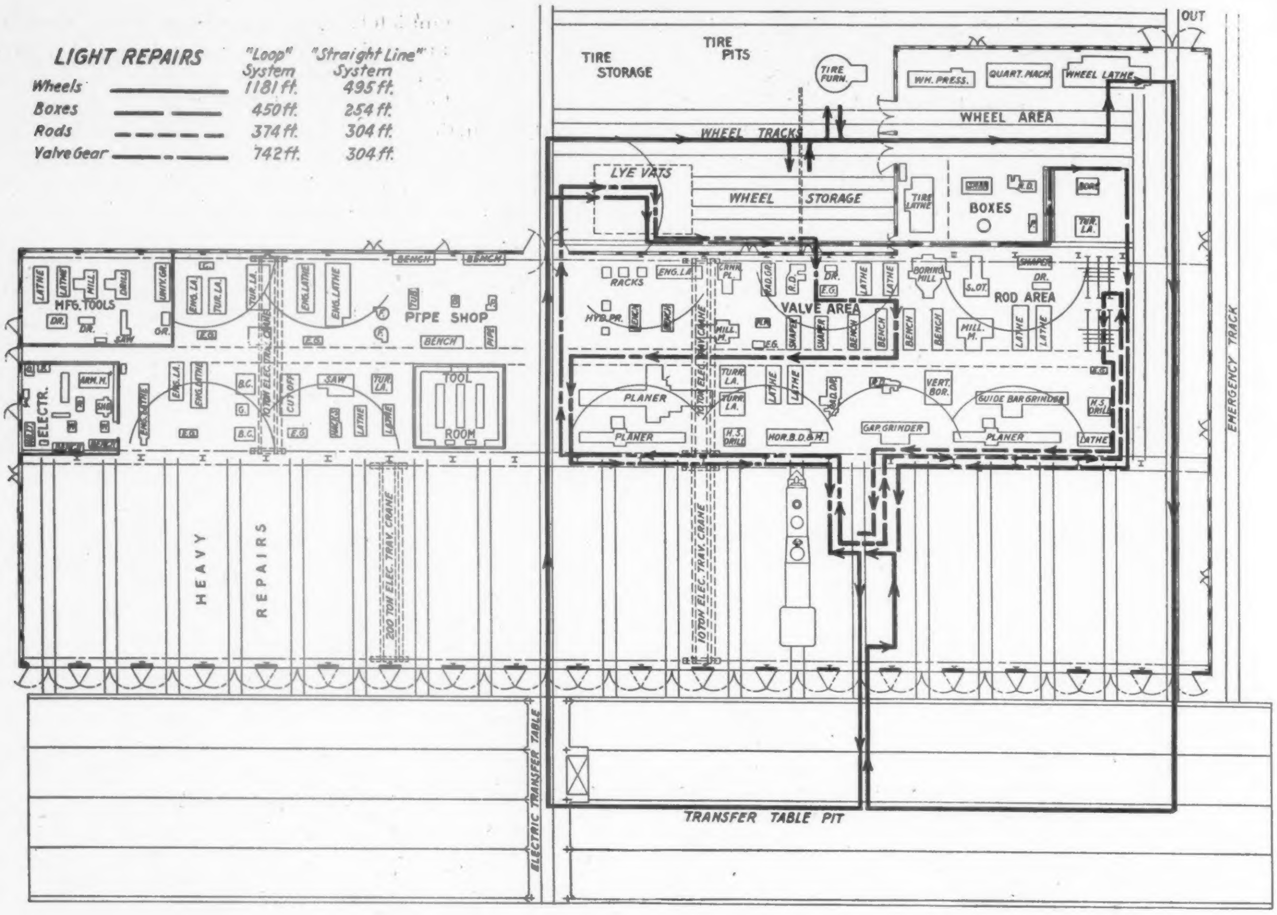


Under the "Straight Line" System Unwheeling and Stripping Are Separated from Wheeling and Assembly

A division of labor makes for increased output. The Chicago & North Western, Atchison, Topeka & Santa Fe and Grand Trunk have separated the locomotive stripping operation with good results. Repetition results in the development of methods and shop kinks, materially reducing the unit times.

In the "Straight Line" shop, the stripping and assembly mechanics are separated. The assembly mechanics are divided between rods, boxes and valve gear. Constant valve setting, for example, soon enables the mechanic to do the operation faster and better by an appreciable percentage. Furthermore, these mechanics do their work at one point instead of all over the shop, which minimizes the walking so that at least 25 per cent unproductive time is utilized. This stationing gives them no excuse to wander about the shop. All their tools are placed where needed.

As many of the operations are only performed by one gang, there is no occasion for "borrowing" parts, as no gang borrows from itself. The permanent location of the rod and valve gangs results in all such parts moving to their particu-



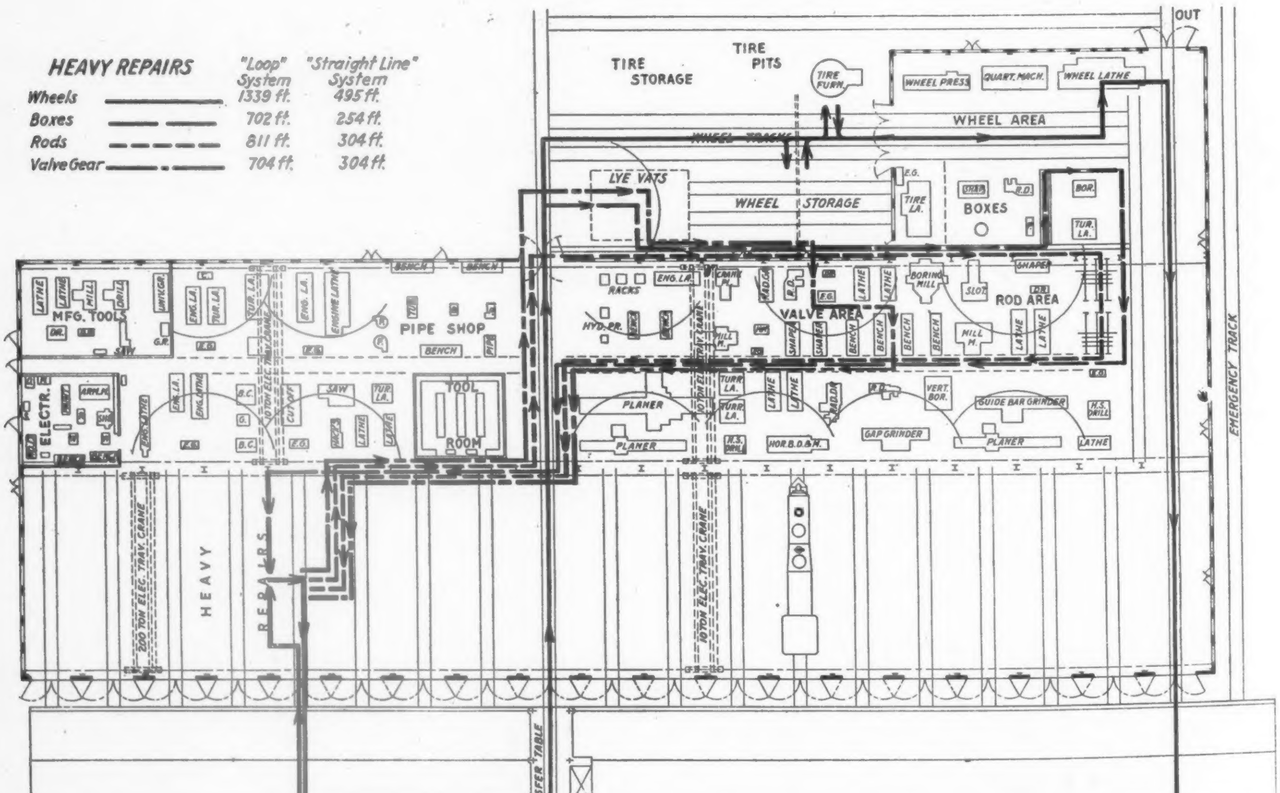


Fig. 1—Chart Showing Movements in Shop Operated Under Ordinary Loop System

lar location on the outbound track. Each member moves to one definite destination.

Minimum Hauling by Separating Operations

When locomotives are stripped throughout a shop, most of the parts must be hauled to lye vats or cleaning points. With this operation confined to one point, the lye vats are located only 25 ft. away from the hoist. The assembling is also done to a large extent at one point. Since both stripping and assembly are concentrated, lines for movement of repair parts between the two points are laid out so as to require a minimum amount of hauling and no lines embody a back haul. Fig. 2 and Fig. 3 show the movements in the shop under the usual system of operation, where each part makes a "loop." The average length of haul for "Straight Line" operation is less than half as much as for operation under the ordinary "Loop" system.

A higher degree of skill and a different type of ability is

The Work Is Brought to the Man

Many shops make a practice of assigning valve motion, links and other special work to certain men. Ordinarily they spend about half their time traveling around a shop from job to job, etc. Under the "Straight Line" method they do the bulk of their work in one place. This permits of a more permanent location, with adequate bench facilities. Instead of hunting most of their work, they get it as it moves past them.

Advantages are enjoyed by the stripping layout, as well as by the assembly. The lye vats are located within 25 feet of the stripping pits, eliminating the dumping of greasy parts about the shop and the hauling from different points. Special containers are placed near the locomotives from which point they are dumped into lye by one man provided with proper facilities.

It will be noted in the layout shown that the wheels are

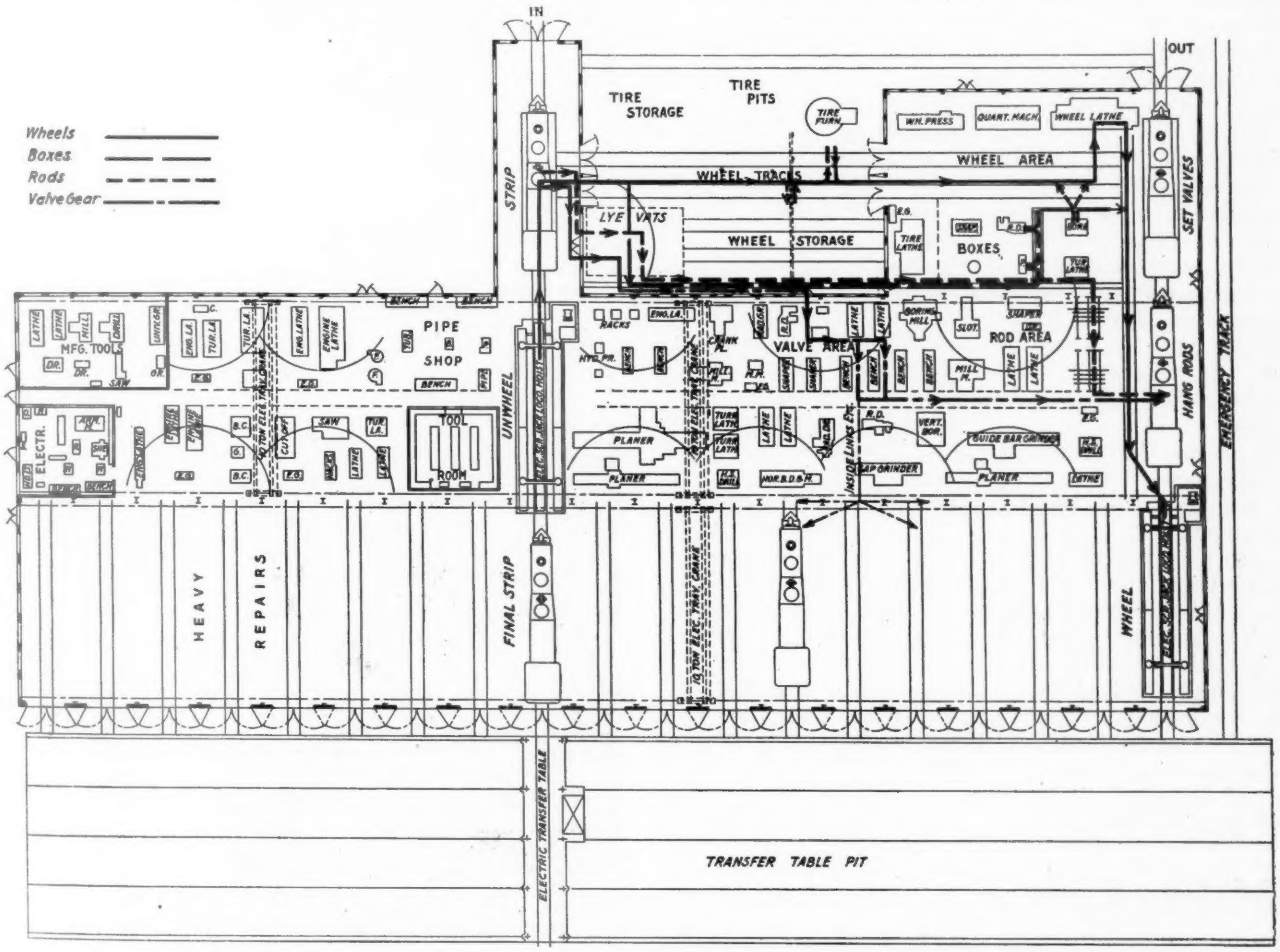


Fig. 2—Chart Showing Movements in Shop Operated Under the "Straight Line" System

required for assembly than for stripping. Division of the two enables the foreman to separate his best mechanics and use them in assembly work where they are most needed. Not only does he use them where they are most needed but he uses them as skilled mechanics all the time.

Straight Line Shops Are Clean

Under the "Straight Line" scheme, all the greasy work is concentrated around the stripping pits and lye vats, the rest of the shop enjoying comparatively clean work—95 per cent of the shop is devoted to clean work. This absence of greasy parts in the main shop and assembly space results in better work, and more of it. Even roundhouse mechanics appreciate clean pits. A business man reacts favorably to good clothes and a mechanic to clean overalls.

kept out of the main shop. It is not unusual to find a back shop with the main aisles blocked with wheels. They take up valuable space under heavy capacity cranes. It is much more economical to get them out of the main shop and under low head room and low capacity cranes. In many shops the space between pits is used for the wheels. Running the wheels around the erecting shop frees the workman of this hindrance.

Since all the parts are stripped on the "IN" track, the inspector who determines the repairs is located there. Being at one point, instead of hunting his work all through the shop, he can also supervise the men doing the stripping. This relieves the foreman so that he can be stationed near the outbound track and can direct the final stages. He is also relieved of the necessity of supervising heavy crane

service, as all of this is done on the hoists. This gives him additional time to devote to the rest of the shop.

Better Scheduling and Many Other Advantages Result from System

By moving in stages it is possible to schedule production as is done in car-building shops and automobile factories. When a locomotive stays in one place from the time it is received until it is finished, a schedule is more or less vague. It takes a lot of the time of a good foreman to size up a shop and check up a schedule under such operation. But actual movement from stage to stage is on a standard schedule. If one stage lags, the work backs up and tends to hurry up the laggards. It is much better for the spirit of a shop to have the pace set thus rather than require the foreman to drive. The self-respect of a mechanic requires that he "hold up his end of a job." Good results have always been obtained by playing gang against gang, the best results being obtained with the shortest unit time. This is effected by dividing general repairs in stages.

There are many shops that were built to handle the smaller locomotives. Many roads have been unable to benefit by larger power on account of shop limitations. Such shops can be salvaged by an adaptation of the "Straight Line" system, in that heavy cranes and excessive overhead clearances are not necessary. The older cranes of limited capacity used for lifting the lighter locomotives will be found strong enough to take care of necessary lifts of parts of the larger locomotives, the heavy lifting in wheeling and unwheeling being done by the hoists. The original cranes perform a service corresponding to that rendered by 10- and 20-ton cranes located on runways under the heavy crane runways in back shops. An expenditure of $30,000 should salvage an obsolete back shop and make it capable of handling the heaviest power.

The movement of locomotives to and from the intermediate points on trucks is the safest way. Handling heavy locomotives over the heads of workmen has always been recognized as dangerous.

In case of emergency, the operation of either the wheeling or unwheeling group may be reversed until the occasion passes. This emergency capacity has a large potential value.

Review of the capital charge of statement shows the "Straight Line" system warranted on that basis alone. All of the benefits derived from "Straight Line" operation add to the net saving. Pacemaking, as a substitute for hard driving, works for better relations between the employees and the supervisory forces. "Straight Line" operation is not a radical departure; it is merely the application of a well proved principle to a new field. It is a logical development.

Making Cylinder Cock Valves

ONE of the interesting jobs done in the locomotive blacksmith department of the Boston & Maine repair shops at North Billerica, Mass., under the direction of Charles Nutter, blacksmith foreman, is the forging of cylinder cock valves in one heat and four operations. The dies are illustrated in Fig. 1, with valves in various stages of completion resting on top of the dies. Round stock is used, the blank after the first operation being shown at *M*; after the second and third operations, at *N*; and after the fourth operation, at *P*. For convenience, *M* and *N* have been formed on the ends of a single piece of stock although this is not usually the practice. The dies are set up in a 3-in. forging machine.

The first operation after heating the stock is to insert it in recess *A*, which forms the valve, nicked to the proper length and with the flash attached, as shown at *M*. In the second operation the valve is inserted at *B* which removes the flash and trims the valve. Any flash that remains is swedged down at *C*, when the valve looks as shown at *N*. The fourth and final operation consists of punching out the slide rod slot, which is done with the valve held upside down in recess *D*. The valve is gripped between the dies, when operation of the forging machine ram with a punch of the proper size forms the rectangular slot in the valve, shown at *P* and also *B* in Fig. 2. These operations are all performed quickly in

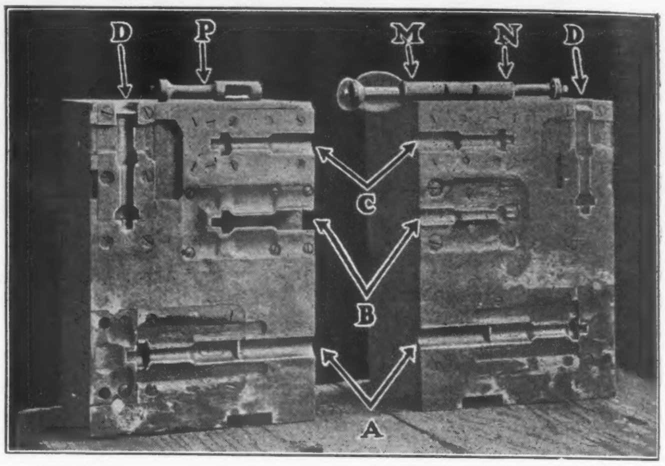


Fig. 1—Dies Used in Forging Cylinder Cock Valves

one heat at a cost of 0.5 cents a piece for labor for forging. The total cost of these valves, including material and labor in forging, is 11 cents.

Machining Operations

The method of machining cylinder cock valves may be of interest, two operations only being required. Referring to Fig. 2 which shows the turret lathe used to perform the

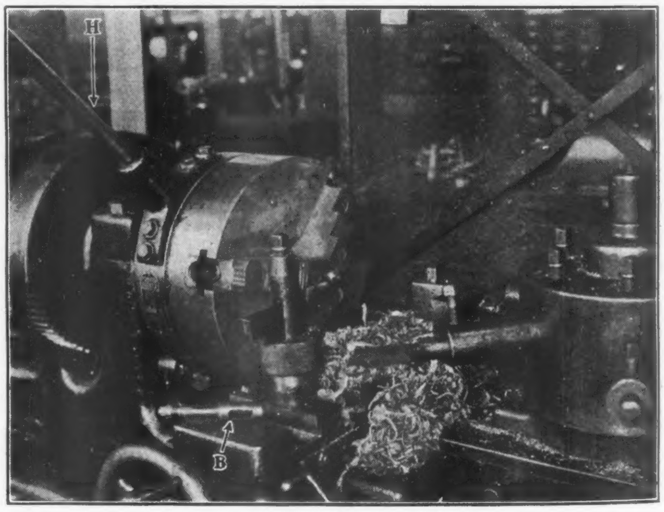
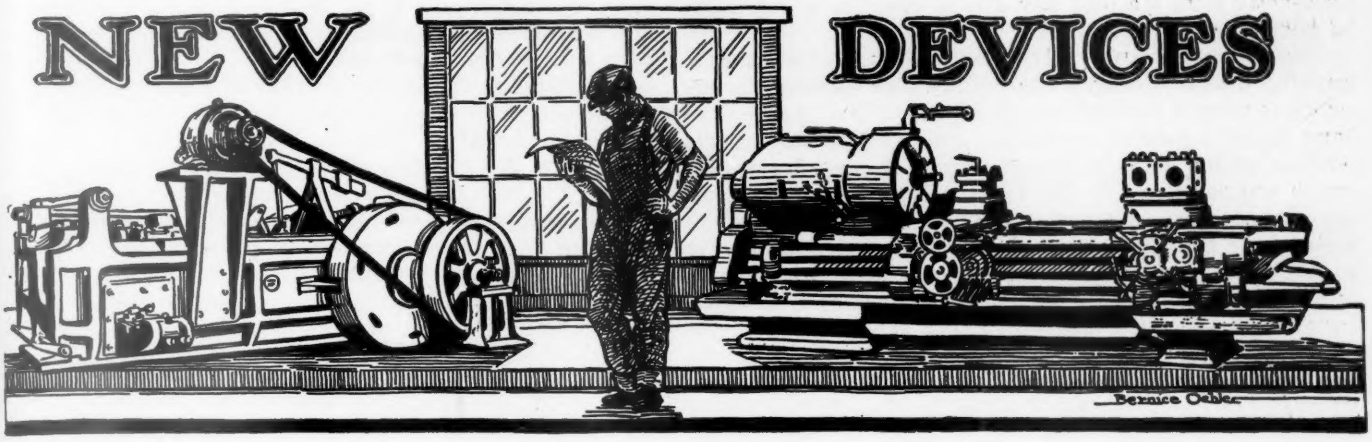


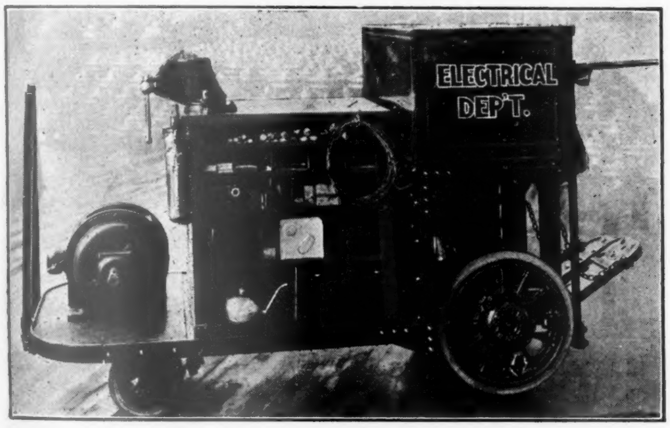
Fig. 2—Barker Wrenchless Chuck Holding Valve for Final Cutting Off Operation

final cutting-off operation, a finished valve is shown at *B* on the cross slide. The only machining necessary on this valve is to turn the outside diameter of the body and form the seat, both operations being performed at one time by a special box tool. The valve stem is then cut off to the required length as shown in Fig. 2, being held in a Barker wrenchless chuck which is particularly adopted for repetition chucking work. By means of lever *H*, the universal jaws of this chuck can be set up or released while the chuck is in motion, the work being centered accurately and quickly by a single pull on lever *H*. This chuck is a time-saver since the jaws can be set approximately to the required size, one pull on the lever tightening them on the work which is thereby centered.



Electric Truck for Shop Emergency Service

A TRUCK designed to meet the needs of millwrights or electricians in the performance of emergency service around shops and factories has recently been developed by the Elwell-Parker Electric Company, Cleveland, Ohio. It provides handy working facilities for the electrician or pipe fitter, whose work is, of necessity, performed in various parts of the shop.



Shop Truck for Emergency Use

The truck is in reality a small, mobile repair shop. It is equipped with a steel and wood case that occupies about two-thirds of the platform, while the balance is reserved for a motor and tool kit. The truck may be driven at three times walking speed and provision has been made for one or two men to ride. A pipe vise is mounted on the partitioned rack to accommodate the usual emergency equipment.

The truck is driven by a battery carried in a large compartment over large rubber-tired driving wheels. The operator stands on a small platform consisting of two pedals. The truck cannot be started unless the operator is on the pedals, and it will stop within its own length if he steps off.

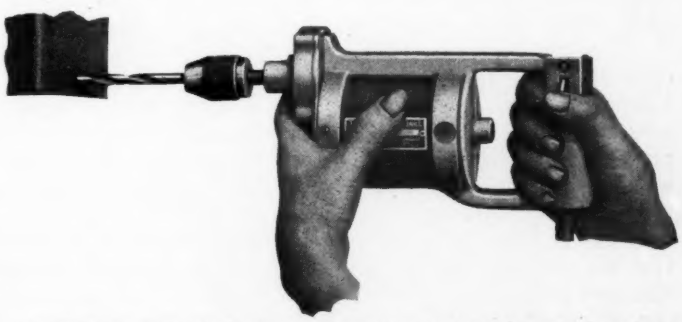
Such a truck is suitable for general electrical maintenance work on locomotives and cars. It is also designed to meet the requirements of a pipe-fitter's gang whose work takes them to all parts of the shop. This truck is capable of transporting the men, tools and material from place to place throughout a shop with little time lost in transit and also provides working facilities after arriving on the job.

Simple and Rugged Electric Drill

THE electric drill illustrated, which weighs less than five pounds, has been placed on the market recently by the Argyle Railway Supply Company, Chicago. This tool will drill holes up to 3/8 in. in diameter and is said to be practically non-stallable. It is well adapted for many drilling operations in railroad shops, including stay bolt tell-tale holes, miscellaneous drilling in car repair work and battery work. A special Westinghouse motor is used which will operate on either alternating or direct current, the motor running at high speed on light loads and slowing down to the required amount when drilling larger holes. The free speed is 2,000 r.p.m. and the full load speed 850 r.p.m., which is approximately the proper cutting speed for a 3/8-in. drill.

The field windings are coated with a special compound and baked 90 hours, resulting in a field coil of one solid mass with practically no possibility of the wires becoming loosened from each other. This adds to the insulation properties, making the armature practically indestructible except from accidental mechanical abrasion. The armature is not injured by immersion either in oils or in water except as this might corrode the metal parts.

The ventilation of the drill brings the cool air into the back both in the upper and lower branches of the handle, assuring that the handle grip will always remain cool and that the incoming air will be distributed to all parts of the motor. The motor field is held away from the housing by ribs which



The Titan Electric Drill is Convenient to Handle and Operate

permit the air to pass around that and also around the armature to cool these parts in the most effective manner. The air is discharged in the front of the housing, tending to

blow away from the drill any dirt or particles which might be raised in drilling operations.

The Titan drill runs only when the operator is actually gripping it and drilling. The position and operation of the switch is natural and the ease of release without shifting the hand makes it possible to stop the motor without shifting the position of the drill, a frequent cause of breakage. This switch was developed for the Titan drill by the Cutler-Hammer Manufacturing Company. The drill is steel armored, designed to be non-breakable, and all parts are riveted together so that there is no danger of the contacts becoming loosened or the plug becoming broken. A durable cord is used which does not lead into the motor itself and can therefore be replaced without the services of an experienced electrician.

A simple and effective lubricating system is used, the two armature bearings and the drill chuck bearings having bronze bushings and spring oilers which retain a considerable amount of lubricant. If the drill is thoroughly oiled for the first few hours of operation it is said to require lubrication only occasionally thereafter.

The thrust in drilling is taken up on a ball-bearing, working between two hardened and ground steel surfaces. The gears are packed in grease. The pinion is of steel, cut directly on the armature shaft and meshing with a bronze gear. The teeth are cut helical, adding to the strength and smoothness of operation. The gear ratio is 7-5½ to 1. This odd number is chosen purposely to prevent the same pair of teeth on the gear and pinion always meeting. The chuck is of the Goodell-Pratt keyless type requiring no tool to open or close it. To prevent the armature from turning when opening or closing the chuck, it is only necessary to press the spring stop into the slot in the end of the armature shaft, this locks the shaft, and the chuck may then be turned without difficulty.

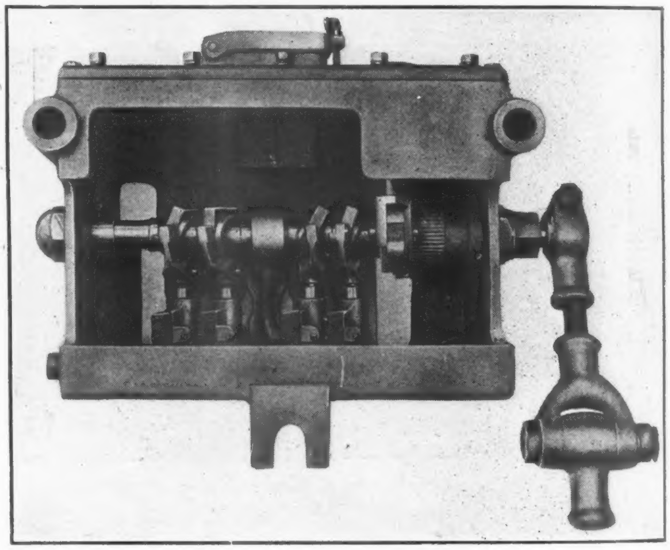
A Valveless Force-Feed Locomotive Lubricator

ONE of the force-feed lubricators for supplying oil to locomotive valve chambers and cylinders now coming into considerable use is shown in the illustration. This is the valveless type of the Madison-Kipp Corporation, Madison, Wis., which has been applied in stationary practice for about 25 years.

The illustration shows the locomotive type lubricator with one side of the oil reservoir cut away to disclose the operating mechanism. It will be seen that the eccentric which gives the oil plungers their vertical motion are provided with bearings the plane of which is inclined so that it is oblique with respect to the center line of the shaft. The plungers are thus given a turning movement so that suitable openings in the plungers register with the inlet and outlet ports, respectively, at the end of the suction and discharge strokes. This movement makes it possible to dispense with valves.

One of the other features of this lubricator is the broad face of the ratchet wheel, which, running in oil, is said to show negligible wear after years of service. The lubricator also contains a special adjusting arrangement which permits the adjustment of the pump feed independently of the range of the driving stroke. This permits a wide variation in the length of the drive arm without making it difficult to adjust the lubricator for the proper oil feed.

Installations of this type of lubricator are now in service on more than 20 railroads and a number of the lubricators have been in constant service for more than two years.



Madison-Kipp Valveless Lubricator with Side Cut Away to Show Operating Mechanism

"Fire Armor" Treatment of High-Speed Steel

A METHOD of treating high speed steel, known as the Fire Armor method has been developed by the Chrobaltic Tool Co., Chicago. It is based upon the principle of obtaining a thorough carbide transformation at the lowest possible temperature. This method, briefly stated, consists of heating the tool in a protected atmosphere to a predetermined temperature a predetermined length of time, which results in the full development of the cutting structure throughout the entire piece at the lowest possible temperature.

It has been determined by carefully conducted experiment that the complete carbide transformation is obtained in the standard modern high speed steel at between 2200 and 2210 deg. F. when held accurately between those temperatures in a protected atmosphere a sufficient length of time to complete the change. The length of time depends upon the volume of the piece, but in no case will it be less than approximately 45 min. after the temperature has been reached. It has been proven that continuing to hold at this temperature for a period of two to three hours does not alter the structure. The releasing of occluded gases occurs at temperatures slightly higher or approximately 2240 deg. F. and that pitting and other surface defects result from the action of these gases being released.

Fire Armor, therefore, gives a fully developed cutting structure throughout without affecting the surface. Resultant tools are stronger physically and are said to have proved, in many cases, several times as efficient for cutting as the average high speed tool. The method provides against overheating the cutter, tool, or part, and the protected atmosphere assures the material being hard up to the very surface; it also corrects materials which are somewhat out of balance and consequently have a prolonged "lag." In a word, this method is designed to overcome most of the irregularities found in high speed steels.

Fire Armor containers for carrying out this method are obtainable in any size or dimension within reasonable limits. While the highest temperature required for the method is 2215 deg. F., the containers themselves are not affected by temperatures up to 2350 deg. F. and are being used in large quantities daily up to the latter temperature.

Twenty-Five and Thirty-Five Ton Geared Jacks

EFFICIENT utilization of man power, ruggedness and simplicity of design are features of the improved Simplex geared jack No. 135 (35 tons capacity) illustrated. This jack, manufactured by Templeton, Kenly & Company, Ltd., Chicago, is also made in a smaller size, No. 125 (25 tons capacity).

Simplex No. 135 Geared Jack

In considering mechanical efficiency, the basic question is:—How much work will the tool perform per unit of time, under standard working conditions? This jack is designed to develop the maximum power under heavy loads, the geared construction giving it the desired power without sacrificing speed. It is said to require only 16 lb. dead weight to lift one ton with the Simplex No. 125 jack, the dead weight being applied at the end of an operating lever six ft. long. A 160 lb. man using this jack and a six ft. oval pole will develop 3,450 ft. lb. per min. In other words, he can lift with the jack a 10-ton load at the rate of about two inches per minute.

The entire working mechanism of this jack is contained in a single unit, the spring link. This spring link as shown in the illustration consists of three steel drop forgings and two steel piano wire springs. In shop tests, these springs are said to have been expanded and contracted over 80,000 times without lubrication. The construction is simple and when repairs are necessary, they can be made with the least possible loss of time. When badly worn, a spring link can be replaced by any mechanic in two minutes or the entire working mechanism, socket, pawls and spring link can be taken apart and reassembled in six minutes.

The pinions and ratchet wheels are keyed as shown in the illustration. The strain that is put on these parts in a jack of this type made it impractical to use any of the ordinary forms of keying and the Simplex integral keying was devised. The pawls and the rack bars and pinions are of chrome nickel steel, the ratchet wheels being 40-50 point carbon steel. All parts are carefully heat treated. The lever sockets are constructed without fulcrum pins, the fulcrum being steel trunnions cast integral with the socket. These trunnions after heat treatment, are said to be unbreakable under service loads.

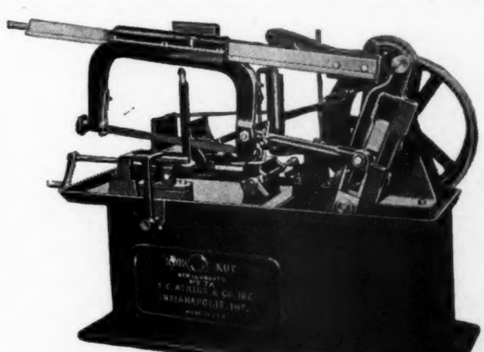
Jacks are frequently put out of service because of a lost part, but in this jack, expansion rivets are provided which cannot loosen under the severest shop service. The side plates are also riveted in position. The arched construction of the standard with its broad, substantial base affords a strong foundation and is another contribution to the cause of safety.

Power Hack Saw with Automatically-Adjusted Stroke

A HACK saw machine, featured by an automatically adjusted stroke and known as the No. 18 Kwik-Kut machine, has been placed on the market by E. C. Atkins & Co., Indianapolis, Ind. This machine has a solid cabinet base which contains the settling tank, compound reservoir and plunger pump. The general construction throughout is heavy so as to make a sturdy machine, practically eliminating vibration and reducing wear to a minimum. A few of the features of this machine are mentioned below.

The stroke, is automatically adjusted according to the size of the material in the vise providing a greater blade travel per minute and consequently a higher cutting speed. Practically none of the hack saw blade is wasted. The machine cuts straight because the saw frame travels on a T-bar, the frame being kept in adjustment by means of screws so that it will always travel in a straight line. The blade holder has a gage, showing whether or not the blade is adjusted perpendicularly to the bottom of the vise, and to the side of the vise. In addition, the blade guide rides on top of the blade, preventing the latter from running side-wise in the cut.

The Kwik-Kut hack saw machine is carefully balanced to reduce vibration and wear. Oil cups are placed where a large amount of oil is required, and oil holes are provided to



Kwik-Kut Power Hack Saw

lubricate other moving parts. The link blocks are made of bronze as these blocks must withstand almost continuous wear. The feed of the machine is controlled by a hydraulic dash pot, and a greater or less feed can be secured by simply turning a by-pass cock. Where a constant feed is required, the by-pass cock can be set for the proper feed. This hydraulic dash pot also acts as a cushion to the raising device so that the blade is lowered into the cut without jar.

Locomotive Headlight With Sealed Metal Reflector

A LOCOMOTIVE headlight case with a hermetically sealed silver-plated copper reflector has been developed by the Pyle National Company, Chicago, Ill. A standard 18-in. by 9-in. parabolic reflector is used which is spun from heavy gage sheet copper, the inside surface being prepared for the quadruple silver plating by a grinding and polishing operation. After plating, the silver surface is burnished and lacquered.

Pyle-National Headlight No. 20-C-300-N Having Illuminated Numeral Display Frames with Parallel Sides

The focusing device is attached to the back of the reflector and is designed to maintain the seal at all times. Use of the device is necessary only in making the focal adjustment for the initial lamp application, unless, on renewal, a lamp is applied which does not conform to specifications. The reflector assembly is held tightly against a gasketed joint in the door frame casting by bronze screws.

The case is fabricated from 16 gage copper-bearing steel or Armco iron. The case is protected on the outside by two coats of flexible black baking enamel and on the inside by the application of an aluminizing preparation. A machine finished cast aluminum-alloy door frame forms the front of the case and a slot-hinged door ring which is also a machine finished aluminum-alloy casting is sealed against a heavy gasket by the tightening of five wing nuts on hinged bolts. When the door is open it swings freely on the hinge, but when it is closed the hinge does not interfere with the action of the bolts and wing nuts. The front glass is made of clear, convex, heat resisting glass, and is held and sealed against the door ring gasket by means of bronze clamp screws.

Lamp replacements are made by loosening the bronze ring nuts and swinging open the front door. This construction makes the fitting of front glasses convenient and avoids the necessity of breaking electrical connection or disturbing the focal adjustments for renewing lamps. The headlight is made in four case styles to comply with requirements for numerical display frames.

Redesigned Vertical Drilling Machine

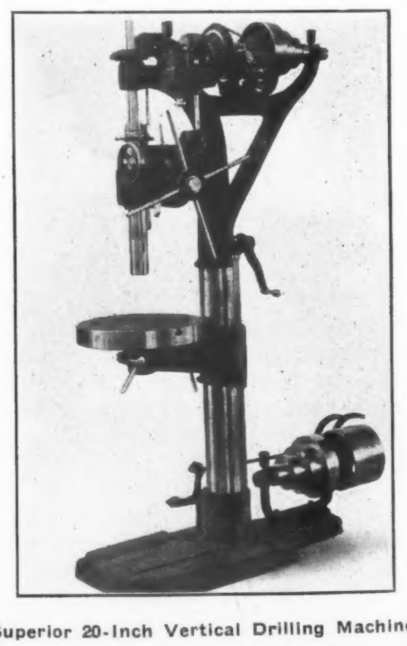
THE 20-in. vertical drilling machine illustrated has been recently redesigned by the Superior Machine Tool Company, Kokomo, Ind., to include bronze bushings, back gears, geared feed and wheel and pilot feeds. Flexibility is secured by the new design and with the unit method of assembly with all parts made on an interchangeable system, the machine may be converted or reassembled to meet varying requirements.

The feed box is provided with steel gears heat treated, reduction being obtained by a bronze worm and gear running in oil. Three feeds are obtainable by shifting a key in the feed box and three additional feeds by a sliding gear on the top shaft.

The column is well proportioned as shown in the illustration, being reinforced at sections subject to heavy strains. The drive provides for a 2-in. belt and pulley and 2¾-in. belt on the counter pulley, which gives all necessary power for drilling within the capacity of the machine. Ample provision for lubrication is afforded for all working bearings.

As shown in the illustration this machine is belt driven; however it can be adapted for motor drive with motor speeds varying from 750 to 1,800 r.p.m.

The height of the machine to the top of the pulley is 74 in., the spindle being 41½ in. above the base. The distance from the table to the spindle is 26 in., the traverse of the spindle sleeve being 8½ in. and the traverse of the table 23¼ in. This machine drills to the center of a 20¼-in. circle. Six spindle feeds from .005 to .018 in. per revolution



Superior 20-Inch Vertical Drilling Machine

are available. When belt driven, a driving pulley 9 in. by 3 in. running at a speed of 450 r.p.m. is used. This gives four direct spindle speeds from 971 to 875 r.p.m. and, with the back gears in, four additional speeds from 25 to 226 r.p.m. can be obtained. A one horsepower motor is required if the machine is to be motor driven.

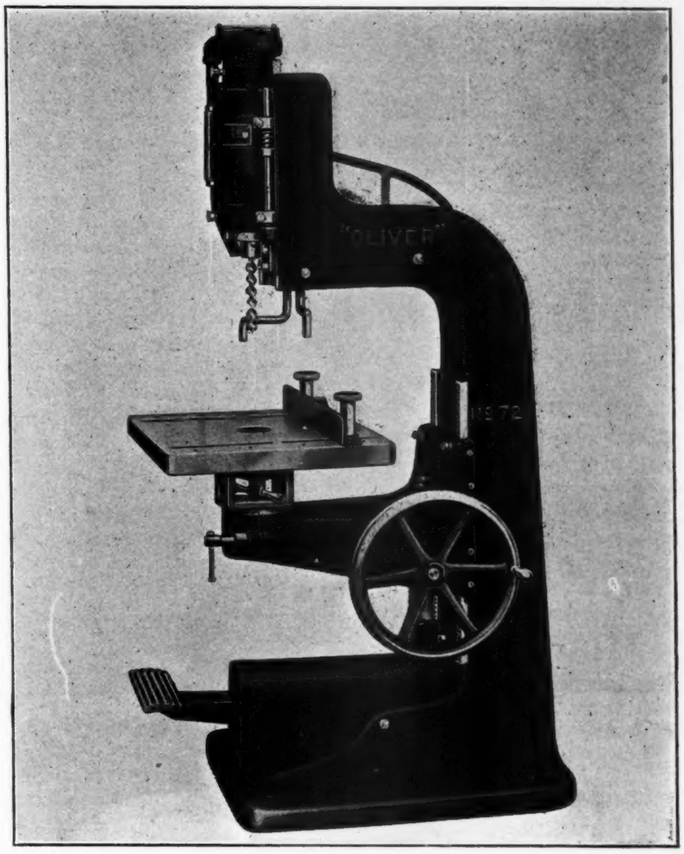
Single-Spindle Boring Machine for Pattern Shops

A VERTICAL, single-spindle boring machine with the rotor of the motor mounted directly on the spindle has been designed by the Oliver Machinery Company, Grand Rapids, Mich. It is known as the Oliver No. 72. This method of providing power for the machine eliminates all belting, countershafts, pulleys and most of the bearings, thereby decreasing the power required and making it a more simple machine. There is a self-contained pressure blower fan mounted directly on the spindle at the top of the machine, to blow the dust and borings away from the work, and also cools the boring bits.

The machine has an adjustable table that can be tilted in any direction up to 45 deg. and is equipped with a scale and pointer to indicate the angle of tilt. It is drilled for wood screws so that a wood table can be fastened to it when desired. Vertical adjustment of the table is controlled by a large hand wheel on the right hand side of the machine, allowing ample room in front of the machine for the operator's knee. All moving parts are carefully counterbalanced, causing less fatigue to the operator.

The maximum stroke of the motor head is 6½ in. Holes up to 2 in. diameter and up to 6 in. deep can be bored with one stroke, to the center of 36 in. The motor housing consists of two halves securely clamped by two large bolts, forming a unit, with planed, dovetailed ways at the rear. The motor itself has no bearings. The rotor, which is keyed to the spindle, runs in ball bearings at the outer ends of the two halves. The motor used is 1½ hp. and can be either 2 or 3 phase, 60 cycle, 220 or 440 volt a.c., 3,600 r.p.m.

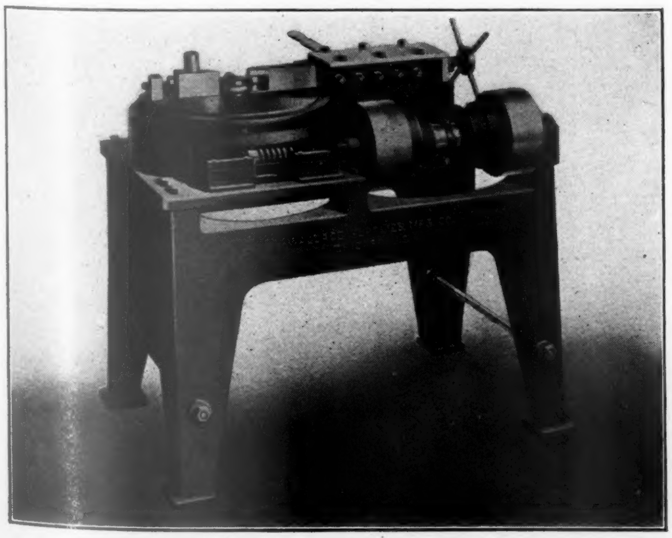
This machine is especially suited to pattern shops because of the great distance, 18 in., from the center of the spindle to the foot of the column. This permits the handling of large or irregular shaped patterns.



Oliver Motor-in-Head Vertical Single Spindle Borer

Strongly Made Bar-Bending Machine

A BAR-BENDING machine featured among other things by its rugged construction has been placed on the market by the Wallis Supply Manufacturing Company, Chicago. This machine is used for bending cold metal bars one inch in diameter, or one inch square, flat shapes ⅜ in. by 2 in. (on edge or flatwise), and angles 2 in. by 2 in. by ¼ in. On hot bending work, 1½-in. squares, or rounds; also flat shapes ¾ in. by 2 in. and angles 2½ in. by 2½ in. by 5/16 in. can be bent.



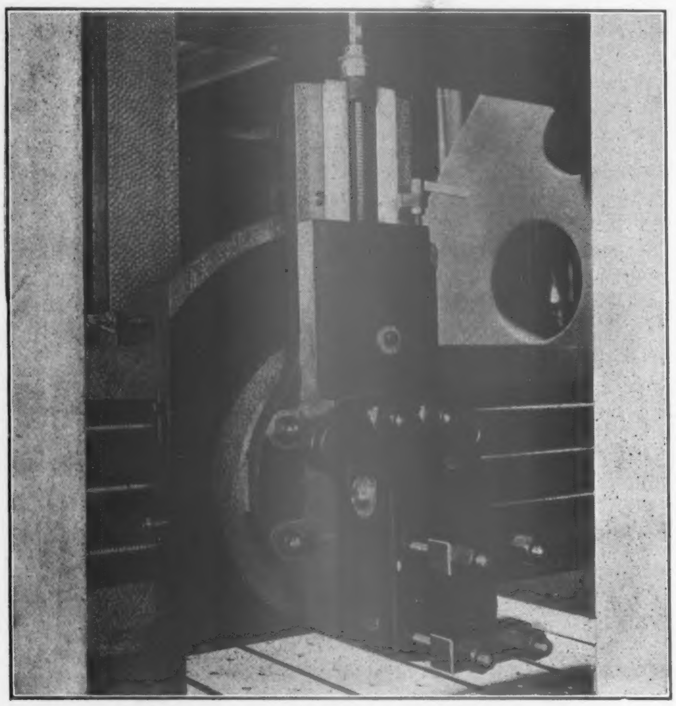
No. 15 Wallace Bar Bending Machine

On the under side of the machine there is an adjustable stop mechanism which provides means for automatically stopping the rotating table at any predetermined point so that materials can be bent identically to any desired number of degrees.

The speed of the rotating table is six revolutions per minute, the production varying according to the number of degrees that the material has to be bent; the length and kind of stock; also the size of the section, etc. The forming of materials on the edge or bending of angles consumes more time than does ordinary rod or bar work on account of the greater difficulty in handling and adjusting. A fair average production estimate for ordinary cold bending to 180 deg. is 150 pieces per hr., based on rounds, squares and flats bent flatwise. The bending of flat stock on edge, or angle iron to more than 180 deg. necessitates the use of a "split form" so that the upper part of the form can be lifted after each bend has been made to allow the removal of the finished part from the machine. For this class of work the average production is about 60 pieces an hour. Three horsepower is required to operate this machine.

Large Size Maximum Service Planers

THE 60-in. and 72-in. planers recently announced by the G. A. Gray Company, Cincinnati, Ohio, complete the line of maximum service planers described on page 777 of the December, 1921, *Railway Mechanical Engineer*. In general the same time and effort-saving features are incorporated with one important addition, namely the Twin-Purpose gibs.



A View of Rail Head Showing Twin-Purpose Gibs

The grouping of the planer controls at the operator's end of the rail eliminates a great deal of walking about hitherto necessary. The operator pushes up the stirrup which hangs at his end of the rail, and thus gives him control of the movement of the rail without leaving the position from which he can see the work and the tools. The rail stops without drifting, so that it may be set at a line. It is then clamped by a few turns of the clamping screw located at the right-hand end of the rail. Having located the rail, the operator can move a rail head into position by simply shifting one lever at his end of rail. Similarly, in spite of the great size and weight of these new planer heads, the slides may be rapidly raised or lowered without effort by using the middle traverse lever at the end of the rail. In other words, these large planers can be handled as quickly as a 36-in. planer.

To set the feed, the same Cantslip feed which has been standardized on the smaller sizes of planers is employed. Any feed between zero and one inch can be had in steps of .01 in. The feed is positive and is not driven through a friction. The oiling of the planer has been most carefully worked out. The gears, which are helical throughout, run in a bath of oil. From the oil pan under the gears oil is taken through a strainer and pumped through a filter to each of the shaft bearings and to the center of each vee.

A close-up view of the rail head, as illustrated, shows the Twin-Purpose gibs provided between slide and harp. A turn of the handle in one direction positively adjusts the gib to the operating position, while a turn in the other direction rigidly locks the slide to the harp. Similar gibs also are provided between saddle and rail. Furthermore, a clamp is provided which clamps the harp to the top of the saddle. These methods of clamping lock the various parts of the head so rigidly together that relative motion, even under the heaviest cutting, is eliminated.

Supplementing these production features, the parts have been built with unusually heavy sections, the cast-iron being distributed in such a manner as to insure the greatest possible rigidity under heavy cutting strains.

General Utility Power Smithing Hammer

A POWER-DRIVEN hammer intended particularly for use on forging work ordinarily performed under hand-swung sledges and too small to be done under steam hammers, is shown in the accompanying illustration. The hammer is termed a "mechanical helper," since it replaces one or two men employed as strikers at each anvil. The same hand tools that the smith ordinarily employs are used with the hammer, without the need of special tools and dies. The hammer, which is stated to greatly increase the capacity and the output per anvil, has recently been placed on the market by the Blacker Engineering Co., Inc., Grand Central Terminal, New York.

The machine is rated to handle material up to 2½ in. thick, although even larger sizes can be cared for. The hammer itself is under the control of the smith, so that either a light or heavy blow can be struck. The force of the blow varies directly with the depression of the treadle extending around the anvil. It is stated that the maximum blow is about four times as heavy as that delivered by a human striker, and that the machine attains a rate of 140 blows per minute. This higher rate of speed and power is important in smith-shop production.

An important feature of the hammer is the lateral traverse motion that can be given to the hammer itself. This motion is controlled by a winged foot lever located at the right of

Power Hammer for Light Forging Work

the anvil and enabling the head to be traveled along the face of the anvil to the desired point.

An anvil and a block of special design to suit the hammer are furnished. The base of the anvil is planed and adjusting screws are provided on the stand, to enable the anvil to be moved forward or backward to get in proper position.

The hammer requires only one horsepower to drive it. It can be run by means of a belt from a lineshaft, being furnished with tight and loose pulleys 15 in. in diameter for this work. A more compact unit is the one driven by an individual motor, as illustrated. The motor is mounted on a small stand on the base and geared to a large driving gear placed on the main shaft. The hammer alone weighs 1,300 lb., the anvil 560 lb., and the stand 336 lb.

Large Flanging Press for Boiler Shop

A FLANGING press, said to be the largest ever built, has recently been constructed for use in a railway shop. It uses an accumulator pressure of 1,500 lb. per sq. in., making a capacity of 1,200 tons. The machine is of the moving-up type, equipped with modern labor and power saving devices and safety appliances. A foundation pit, 8 ft. wide, 25 ft. long and 18 ft. deep, is required as the floor level in which the press is placed comes slightly below the face of the middle platen, which is the moving member.

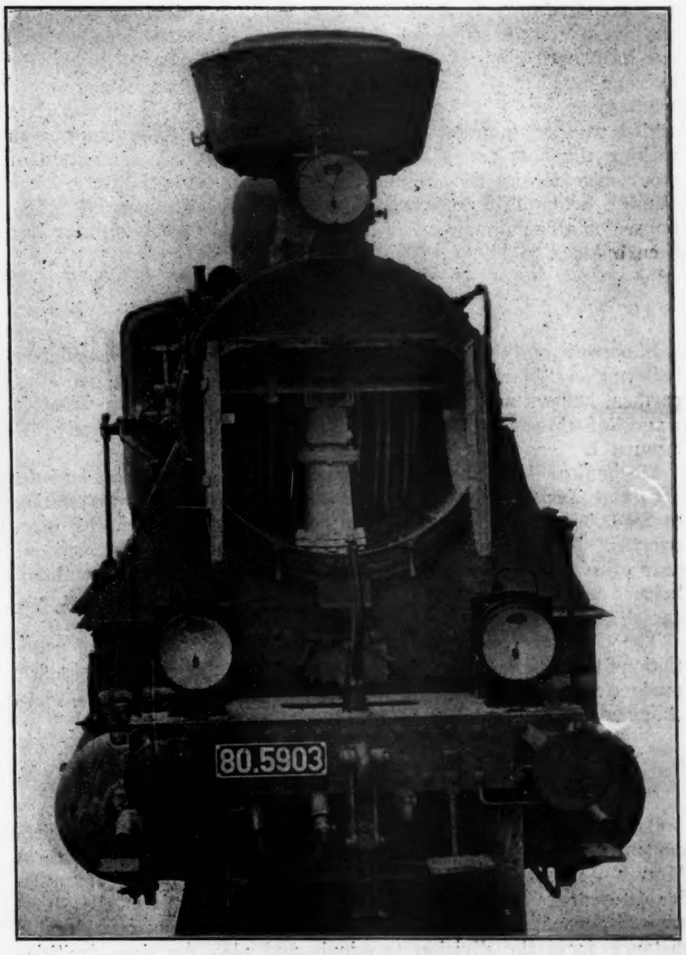
1,200-Ton Hydraulic Press Built by the Birdsboro Steel Foundry & Machine Co.

The press, built by the Birdsboro Steel Foundry & Machine Company, Birdsboro, Pa., is of the four-column type, each column being 13 in. in diameter and 30 ft. in length. The clearance between columns is 15 ft. one way and 11 ft. 11 in. the other way. The platens are 15 ft. by 18 ft., 3 in., permitting the flanging of large steel plates. This construction makes available a flanging bed 15 ft. by 15 ft. The top and moving platens are provided with a multiplicity of longitudinal T-slots to accommodate bolts for fastening dies.

The columns have long threads on the upper ends, thereby providing an adjustment between the top and moving platens of from 12 ft. maximum to 5 ft. minimum. The inner nuts supporting the upper platen are made in halves, and the outer nuts are split on one side to permit the use of a wedge for slackening while they are being raised or lowered in adjusting the clearances.

Six ranges of power may be exerted by the press, which has three main cylinders and plungers 26 in. in diameter each with a lift of 6 ft. By admitting 1,500 lb. accumulator pressure to the center cylinder, only 400 tons will be exerted. When pressure is admitted to the other two 26-in. cylinders simultaneously, a pressure of 800 tons will be obtained, and by applying pressure to the three cylinders, 1,200 tons will be obtained.

It is possible to exert three additional pressures by using the four jack rams in conjunction with either of the above three combinations. These rams are 9 in. in diameter and also are used for raising and controlling the motion of the moving platen while running up to the work. The press is cast steel construction throughout, with the exception of the plungers, which are of chilled iron, ground and polished, and the tension bolts, which are of steel forged from metal cast ingots. The total weight of the press is over 300 tons.



An Austrian 0-10-0 Equipped with Lentz Feed-Water Heater and Schmidt Superheater

GENERAL NEWS

Decisions of Labor Board

The third annual edition of the decisions of the United States Railroad Labor Board has been published and is being distributed. In this edition certain miscellaneous subjects heretofore included have been left out. A separate volume is to be issued containing the cumulative index digest which will contain reference to all the decisions issued by the board. In all other respects the subjects included in this volume are the same as in previous editions and the general arrangement is maintained. The volume contains 904 decisions handed down during 1922.

Injunction Against Great Northern "Company" Union

A temporary injunction restraining the Associated Organization of Shopcraft Employees of the Great Northern from interfering with members of the Federated Shopcrafts has been granted to the latter organization by United States District Judge John B. Sanborn at St. Paul, Minn. Since the formation of the "company" union in July of last year the national shopcrafts' organization claims that its members returning to work have been denied membership in the local union. B. M. Jewell, president of the federated shopcrafts, is quoted as saying that there is no intention to seek such injunctions in other sections.

Bonuses at C. & A. Storehouse

Since installing a bonus system at the general storehouse of the Chicago & Alton as an inducement to fill requisitions promptly, the average number of requisitions being held has been reduced one-half as compared with those held in January, while the average number of days required to fill them has been reduced from 43 to 16. The bonus consists of two days off or two days added to the summer vacation and is given to the stock man making the best record in filling requisitions. A committee of stock men decides the winner of the bonus. On January 1 the number of unfilled department requisitions at the general storehouse for all sections totaled 299, and on June 18 this number had been reduced to 119.

Wage Increases

Shopmen on the Cincinnati Northern, including machinists, boilermakers, blacksmiths, sheet metal workers, electrical workers, carmen, helpers and apprentices, have been granted an increase in wages of three cents an hour. This increase is retroactive to August 1.

Mechanical department employees on the Maine Central and the Portland Terminal have been granted wage increases amounting to $58,000 annually. Machinists, boilermakers, blacksmiths, electricians, sheet metal workers, carmen and helpers with over one year of service have received an increase of three cents an hour, helpers with less than one year of service, one cent an hour and car cleaners, 1½ cents an hour.

The Cleveland, Cincinnati, Chicago & St. Louis, following negotiations with representatives of the federated shopcraft unions, has made a general advance of three cents an hour in the wages of shopmen; said to number 4,000 individuals.

P. R. R. Abandons Mount Vernon Shops

Orders have been issued by the Pennsylvania Railroad permanently closing the shops of the Akron Division located at Mount Vernon, Ohio, which have been in continuous operation for 50 years. It is said that the decision to abandon the shops was on account of Mount Vernon being located at a considerable distance from the division terminals and also the shop facilities being inadequate to handle the locomotives now used by the Pennsylvania. Over a year ago a portion of the shops was damaged, entailing a loss of $100,000. Reconstruction work was started but never completed. Over 300 men now employed at the Mount Vernon shops will be sent to other shops on the Pennsylvania. These men will be given their preference as to the plan of employment and will retain their seniority rights.

Wage Statistics for June

The total number of employees reported by Class I railroads for the month of June, 1923, was 1,933,929; which exceeds the number reported for any month since November, 1920, according to the Interstate Commerce Commission's monthly bulletin of wage statistics. Compared with the returns for the same month last year, the total shows an increase of 248,515, or 14.7 per cent. The largest increase appears in the maintenance of equipment group and is accompanied by a substantial increase in the number of hours worked per employee. Compared with those for May, 1923, the returns for June, 1923, indicate an increase of 37,710 in the total number of employees, or 2 per cent. The compensation, however, shows a decrease of 0.2 per cent, which is explained by a decrease in the total hours worked. Due to a fire which destroyed certain records of the Erie and subsidiaries, only partial returns were furnished by these roads; data covering 7,712 employees and $1,017,915 compensation have been omitted.

Canadian Union President Attacks Labor Board

The Railway Labor Board was denounced as a "tool of the employers" in an address by A. R. Mosher, president, at the convention of the Canadian Brotherhood of Railway Employees at Calgary, Alta., on September 17. Mr. Mosher also declared the strike to be "too powerful a weapon" for workers engaged in an essential public service to employ. In referring to the Labor Board, Mr. Mosher said, "It is a greater menace to railway employees than any other combination of individuals on the North American continent." He accused the board of aiding railway managements "in their attacks upon the pay envelopes of workers" and referred to it as a "United States Government tribunal which has made itself ridiculous in the eyes of every right thinking person on this continent by declaring that a living wage for workers is impracticable and impossible." He said further that except where the workers directly block the practice, Canadian railways apply the decisions of the board so that employees in the Dominion are as much affected by its judgment as are their fellow craftsmen in the United States, although the Labor Board is not supposed to have jurisdiction on the Canadian side.

Locomotive Shipments

Department of Commerce reports based on returns from the principal manufacturing plants show that the builders made shipments in August of 272 locomotives as compared with 239 in July. In the first eight months of 1923, shipments totaled 1,916 as compared with 641 in the corresponding period of last year. At the end of August unfilled orders totaled 1,497 as compared with 1,738 at the end of July. The detailed figures showing the proportion of foreign and domestic business and giving comparisons with preceding periods follow:

	August, 1923	July, 1923	August 1922	Eight months' total January to August 1923	Eight months' total January to August 1922
Shipments:					
Domestic	259	211	130	1,802	472
Foreign	13	28	21	114	169
Total	272	239	151	1,916	641
Unfilled orders: (end of month):					
Domestic	1,406	1,652	926	....	....
Foreign	91	86	109	....	....
Total	1,497	1,738	1,035	....	....

The Fastest Train in Great Britain

The train which has the fastest schedule of any in Great Britain is operated by the Great Western Railway from Cheltenham to

Miles Distant from Paddington		Schedule time p. m.	Actual time p. m.
77.3	Swindon	3:45	3.45
53.1	Didcot	4:09	4:09½
36	Reading	4:25	4:24
24.1	Maidenhead	4:35½	4:33½
18.5	Slough	4:40½	4:38½
9.1	Southall	4.49	4:47
...	Paddington	5:00	4:57

Paddington (London) and covers the distance from Swindon to Paddington, 77¼ miles, in 75 min.—or at the rate of 61.8 miles per hour.

On the first run the train gained on its schedule so that the Swindon-Paddington run was made at an average speed slightly in excess of 64¼ miles per hour. The schedule time and actual time on the initial run are shown in the accompanying table. At one time a speed of 83 miles per hour was reached.

The locomotive is of the two-cylinder, 4-6-0 type. It has 18½-in. by 30-in. cylinders, drivers 80½ in., a heating surface of 2,124.8 sq. ft. and has a working pressure of 225 lb.

The locomotive is green in color and the cars chocolate and cream, according to Great Western standards. The usual train weighs 250 long tons.

New Boiler Law in Pennsylvania

Two laws pertaining to the collection of fees for services rendered by the Department of Labor and Industry, Commonwealth of Pennsylvania, in the administration of the rules and regulations of the department covering boilers and elevators, were passed at the last session of the legislature.

The boiler law provides for the inspection of boilers by representatives of insurance companies and by salaried employees of the Department of Labor and Industry. Owners and users of boilers will be required to forward to the Department of Labor and Industry a fee of one dollar before the annual certificate of operation for the boiler will be issued. When boilers are inspected by representatives of the Department of Labor and Industry a fee of six dollars and fifty cents ($6.50) will be collected for each external and internal inspection made while the boiler is not under pressure, and two dollars and fifty cents ($2.50) for external inspection made when the boiler is under pressure.

Persons desiring to take examination for boiler inspector are required to pay a fee of ten dollars ($10.00) at the time of making application for examination. If the applicant is successful in passing the examination a certificate of competency and a commission card will be issued without further charge. It is the plan of the Department to put this law into effect as soon as the necessary forms can be printed.

New Equipment for Long Island

The Long Island Railroad has authorized the purchase of new equipment to cost about $2,863,000, consisting of 60 steel motor passenger cars for electric service, 5 large passenger locomotives for heavy express trains, 5 heavy freight locomotives, and 200 gondola cars or open-top cars for general use, such as the hauling of stone and gravel for road building and other traffic requiring this character of equipment. Contracts for this equipment are to be let not later than October 15. This is about two months sooner than the 1923 car and locomotive program was made up, and assures delivery of all the new equipment covered by the above appropriation, in ample time for the 1924 summer traffic. There are still 40 steel motor passenger cars, 10 steel passenger coaches for steam service, and two steel mail cars due for delivery under the 1923 contracts. This means that when the summer rush of 1924 comes, the road will actually have 110 passenger cars more than the equipment available for the season of 1923. These 110 additional cars will provide seating capacity for 8,380 passengers, and make it possible for the Long Island to adequately care for the normal increase in traffic, which averages from 5,000 to 8,000 passengers per day, compared with the previous year. On December 31, 1922, the equipment register of the Long Island showed that the company owned 1,210 passenger train cars, of which 310 were of wooden and 900 of steel construction. With the 92 additional steel passenger cars ordered for 1923 delivery, and the 60 now to be placed on order, and deducting 80 wooden cars of the older type that have been retired, the passenger equipment will total 1,282 cars at the end of 1924, of which 1,052 will be of steel, and 230 of wooden construction. Of the wooden cars, only 160 will be utilized for carrying passengers, the balance for the handling of express, baggage and mail traffic.

MEETINGS AND CONVENTIONS

Dixie Railway Club Organized at Mobile

The Dixie Railway Club has been organized at Mobile, Ala., for the purpose of advancing the science of railroading, and bringing into closer relationship railroaders, railway supply men and employees of water transportation lines. The associate membership also includes traffic managers of chambers of commerce and industries. The club has about 200 members. G. P. Brock is president, J. H. Cassidy and R. G. Lauten are vice-presidents, R. C. Schley is secretary and G. M. White is treasurer.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

Air-Brake Association.—F. M. Nellis, Room 3014, 165 Broadway, New York City.

American Railroad Master Tinners' Coppersmiths' and Pipefitters' Association.—C. Borcherdt, 202 North Hamlin Ave., Chicago.

American Railway Association, Division V.—Mechanical. V. R. Hawthorne, 431 South Dearborn St., Chicago.
Division V.—Equipment Painting Division.—V. R. Hawthorne, Chicago.
Division VI.—Purchases and Stores.—W. J. Farrell, 30 Vesey St., New York.

American Railway Tool Foremen's Association.—W. C. Stephenson, Atlantic Coast Line.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Railroad Division, A. F. Stuebing, 23 West Forty-third St., New York.

American Society for Testing Materials.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

American Society for Steel Treating.—W. H. Eiseman, 4600 Prospect Ave., Cleveland, Ohio. Convention October 8-12, Ballroom William Penn Hotel, Pittsburgh, Pa.

Association of Railway Electrical Engineers.—Joseph A. Andreucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill. Annual convention November 6-9, Hotel La Salle, Chicago. Exhibit by Railway Electrical Supply Manufacturers' Association.

Canadian Railway Club.—W. A. Booth, 53 Rushbrook St., Montreal, Que. Meeting October 9. Paper will be read on Crossing Accidents; Their Cause and Prevention, by George A. Kell, safety engineer, Canadian National Railways, Toronto, Ont. Stereopticon views.

Car Foremen's Association of Chicago.—Aaron Kline, 626 N. Pine Ave., Chicago, Ill. Meeting second Monday in month, except June, July and August, Great Northern Hotel, Chicago, Ill.

Car Foremen's Association of St. Louis.—Thomas B. Koeneke, 604 Federal Reserve Bank Building, St. Louis, Mo. Meetings, first Tuesday in month at the American Hotel Annex, St. Louis.

Central Railway Club.—H. D. Vought, 26 Cortlandt St., New York, N. Y.

Chief Interchange Car Inspectors' and Car Foremen's Association.—W. P. Elliott, T. R. R. A. of St. Louis, East St. Louis, Ill. Annual meeting Hotel Sherman, Chicago, October 3, 4 and 5.

Cincinnati Railway Club.—W. C. Cooder, Union Central Building, Cincinnati, Ohio. Meetings second Tuesday, February, May, September and November.

International Railroad Master Blacksmiths' Association.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich.

International Railway Fuel Association.—J. B. Hutchison, 6000 Michigan Ave., Chicago, Ill.

International Railway General Foremen's Association.—William Hall, 1061 W. Wabash St., Winona, Minn.

Master Boilermakers' Association.—Harry D. Vought, 26 Cortlandt St., New York, N. Y.

New England Railroad Club.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Meeting October 9, Copley-Plaza Hotel, Boston. Paper on Looking Ahead presented by R. H. Aishton, president of American Railway Association. Entertainment during dinner.

New York Railroad Club.—H. D. Vought, 26 Cortlandt St., New York. Meeting third Friday of each month except June, July and August at 29 West Thirty-ninth St., New York.

Niagara Frontier Car Men's Association.—George A. J. Hochgreb, 623 Brisbane Building, Buffalo, N. Y.

Pacific Railway Club.—W. S. Wollner, 64 Pine St., San Francisco, Cal. Next meeting October 25. E. T. Howson, editor of Railway Engineering and Maintenance, will speak on Some Operating Phases of Maintenance Work.

Railway Club of Greenville.—G. Charles Hoey, Plum street, Greenville, Pa. Meetings last Friday of each month, except June, July and August.

Railway Club of Pittsburgh.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Next meeting October 25. Annual meeting, election of officers, smoker. Will entertain American Welding Society.

St. Louis Railway Club.—B. W. Frauenthal, Union Station, St. Louis, Mo. Meetings second Friday each month, except June, July and August.

Traveling Engineers' Association.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio.

Western Railway Club.—Bruce V. Crandall, 605 North Michigan Ave., Chicago. Meetings third Monday in each month, except June, July and August.

SUPPLY TRADE NOTES

The Truscon Steel Company is preparing plans for a new plant at Pittsburg, Cal.

The Standard Steel & Bearings, Incorporated, has moved its Philadelphia, Pa., plant to Plainville, Conn.

S. Douglas Gibson, dealer in railway supplies has removed his offices from the Home Life building, to Suite 744, Transportation building, Washington, D. C.

The Superheater Company is preparing plans for the erection of a 120-ft. by 210-ft. addition to its plant at East Chicago, Ind., to cost approximately $75,000.

David G. White has joined the staff of the Hardwood Manufacturers Institute, Chicago, as forest economist and as an assistant to J. M. Pritchard, secretary-manager.

H. D. Conkey & Company, Mendota, Ill., manufacturers of cranes and industrial cars, have appointed the Florandin Equipment Company as New York sales agents.

The Prime Manufacturing Co., Milwaukee, Wis., contemplates the erection of a modern brass foundry of approximately 15,000 to 18,000 sq. ft. No definite plans have as yet been made.

C. F. McCuen, representative of the W. H. Miner Company, with headquarters at Chicago, has been appointed general sales agent of the Camel Company, with the same headquarters.

D. R. Day, resident manager of the Hall Switch & Signal Company, with headquarters at Chicago, has been appointed sales manager of the Bryant Zinc Company, with headquarters in the same city.

S. G. Eastman, western sales manager of the Niles-Bement-Pond Company, with headquarters at San Francisco, Cal., has been transferred to Chicago, to succeed G. F. Mills, Chicago sales manager, retired.

R. W. Benson, eastern representative at New York City of the Flannery Bolt Company, Pittsburgh, Pa., has resigned, and the company has closed its eastern office at 41 East Forty-second street, New York City.

Fairbanks, Morse & Co. have purchased a tract of land formerly owned by the county workhouse at Indianapolis, Ind., and are planning to erect a new factory building adjoining the present plant, which covers 4½ acres.

W. M. Bosworth has resigned as mechanical engineer of the Wine Railway Appliance Company, Toledo, Ohio, and is now affiliated with the Met'l Fibre Rope Company, Toledo, as vice-president and factory manager.

J. A. Cranston, northwestern manager of the General Electric Company, with headquarters at Portland, Ore., has been appointed Pacific Coast manager with headquarters at San Francisco, Cal., succeeding Dr. Thomas Addison, resigned.

The American Car & Foundry Company has purchased a tract of land 260 ft. by 1,931 ft. extending from the south branch of the Chicago river almost to Blue Island avenue and fronting on Wood street, Chicago, from the Edward Hines Lumber Company.

The Sullivan Machinery Company on August 11 formally opened its new western plant at Michigan City, Ind., which will replace the former plant located in Chicago. This company was organized in 1869 at Claremont, N. H., at which point their eastern plant is still situated.

N. B. Norris has been appointed manager of the New Orleans, La., office at 938 Whitney-Central building, of the Pawling & Harnischfeger Company, Milwaukee, Wis. This company has opened a new office at 1124 Book building, Detroit, Mich., with James Van Buskirk in charge.

Major Walter Gresham Andrews, of the sales department of Pratt & Lambert, Inc., Buffalo, N. Y., has been elected a member of the board of directors. Harold E. Webster, purchasing agent, has been appointed secretary and Walter P. Werheim, advertising manager, has been made a director of the company.

The Consolidated Car-Heating Company, Albany, N. Y., has secured the patents, equipment, good-will and other assets of the Automatic Ventilator Company of New York City. The Consolidated Car-Heating Company is now prepared to fill orders for all types of automatic ventilators heretofore supplied by the Automatic Ventilator Company.

The Michigan office of the Truscon Steel Company, Detroit, Mich, is now located in its new building at 615 Wayne street, Detroit, occupying the entire second floor. The office includes a complete service organization and engineering department. The general advertising department of the company also is located on the same floor with the Michigan office.

Walter A. Deems has been appointed representative of the machine tool department, New York district, of Manning, Maxwell & Moore, Inc., with headquarters at 100 East Forty-second street, New York City. For the past ten years Mr. Deems served as master mechanic of the Baltimore & Ohio's New York Terminals and the Staten Island Rapid Transit Company, with headquarters at Tompkinsville, Staten Island, resigning on September 15, to go with Manning, Maxwell & Moore, Inc.

W. E. Corrigan, of the sales department American Locomotive Company, has been appointed general sales representative of the company on the Pacific Coast with the title of district sales manager and headquarters in the recently established branch office, Rialto building, San Francisco, Cal. Mr. Corrigan entered the service of the American Locomotive Company in 1909 and is a graduate of the four-year-course in locomotive construction which the company conducts in its engineering department in Schenectady. From May, 1913, he served in various capacities in the drawing office in Schenectady until 1915, when he was transferred to the Cooke plant, Paterson, N. J., where he was employed on elevation work and general calculating. He remained in this service until November, 1917, when he entered the United States Army where he served successively as second lieutenant, first lieutenant and captain in the artillery ordnance branch, field service, in charge of plant production at several gun carriage and ammunition plants. After the armistice, he became secretary and then ordnance district chief and chairman of the claims board in charge of the settlement of claims arising out of the cancellation of war contracts between the government and various manufacturers. In 1920, he re-entered the employ of the American Locomotive Company, serving for two years in the sales department at New York, when he was transferred to Chicago as salesman for Alco accessories in the middle western territory and subsequently was transferred to the Pacific Coast.


W. E. Corrigan

John Brunner, assistant inspecting engineer of the Illinois Steel Company, with headquarters at Chicago, has been promoted to manager of the newly created department of metallurgy and inspection, with the same headquarters. R. G. Glass has been appointed assistant manager in charge of the bureau of investigation, and F S. Crane has been appointed assistant manager in charge of the bureau of inspection of the department of metallurgy and inspection, both with headquarters at Chicago.

The J. W. Griffin Lumber Company, Burnside, Miss., has sold to the Reynolds-West Lumber Company 300,000,000 ft. of long and short leaf pine located near Burnside. P. J. M. Reynolds is president of the new company and J. M. West is vice-president. M. P. Barton, until recently with the Peavy Byrnes Lumber Company, will be manager of the Burnside mill. Plans for the future contemplate the construction of a new hardwood mill to be built by the Reynolds-West Lumber Company at Burnside this year.

The Connecticut Blower Corporation, Hartford, Conn., has been incorporated under the laws of Delaware with a capital of $200,000 and has taken over the International Blower Company and the Hartford Sheet Metal Works. The new company will manufacture and install blower systems of all kinds, exhaust fans, dust collecting systems, exhaust systems and ventilating systems. M. E. Keeney is president; C. H. Keeney, treasurer, and C. E. Keeney, secretary,—all with headquarters at Hartford, Conn.

Stanley H. Smith, who represented the Pennsylvania Steel Company and the Bethlehem Steel Company in Cleveland and Chicago, and since leaving the latter company has been acting as a manufacturers' agent at 422 Frankfort avenue, Cleveland, Ohio, has been appointed district representative for Ohio for the Titusville Forge Company, of Titusville, Pa. Mr. Smith represents the Wyoming Shovel Works, the National Lock Washer Company, Harrisburg Pipe & Pipe Bending Company, and the Stevens Metal Products Company.

J. Leonard Replogle, who has resigned as president of the Vanadium Corporation of America, New York, on account of ill health, as was announced in the September issue of the *Railway Mechanical Engineer*, remains as a director of the corporation and when his health is restored will devote most of his time to his other interests including the Replogle Steel Company of which he is chairman. Mr. Replogle was born in Bedford County, Pa., on May 6, 1876, and received his education in the public schools of Johnstown. At the age of 13, he entered the employ of the Cambria Steel Company as office boy where he served successively in various positions until September, 1912, when he was elected vice-president and general manager of sales. He resigned in February, 1915, from the Cambria Steel Company to become vice-president and general manager of sales of the American Vanadium Company and in 1917 became president and general manager of sales of the same company, which in 1919, became part of the Vanadium Corporation of America. Mr. Replogle is also president of the Wharton & Northern Railroad and a director of the Wabash Railway Company and other companies. He also served during the war as director of steel supplies for the War Industries Board. In recognition of the services he rendered for the Allied cause, he has received from the United States the Distinguished Service Medal and decorations from the French, Belgian and Italian governments.

J. Leonard Replogle

The Elk Machine Tool Corporation has taken over the Elk Manufacturing Company of New York City. The new company will continue to manufacture and sell precision tools under the Elkin patents. The new company will be located on July 15 in its new plant at 243 West Seventeenth street, New York City. The company will have direct representatives and branches located in about twenty-five cities. J. C. Elkin, inventor and mechanical engineer, is president of the new company and will have charge of the manufacturing and production.

Exum M. Haas has resigned as manager of the railroad department of the H. K. Ferguson Company, Cleveland, Ohio, to open an office as consulting engineer at 2075 Taylor Road, Cleveland, Ohio. Mr. Haas will retain a connection with the Ferguson Company as consulting engineer on railroad projects and will specialize in railroad shop and terminal planning. He has been engaged in this phase of railway construction since 1917, having served as sales engineer for the Austin Company for three years and since August 1, 1920, as manager of the railroad department of the H. K. Ferguson Company.

The Continental Lumber & Tie Company has been incorporated at Peoria, Ill., with a capital stock of $1,500,000. Sales headquarters will be at St. Louis, Mo. The company represents a combination of several concerns operating saw mills, railroads, steamboats, barge lines and the rafting of logs. The incorporators are C. J. Case; Leonard Hillis; W. C. McClure and G. A. Case, of Peoria, Ill.; J. H. Hines, Memphis, Tenn.; Sterling Lumber Company, Bastrop, La.; J. H. Allen, St. Louis, Mo.; B. J. Altheimer, Chicago; J. H. Hines, Inc., and B. K. Boyston, Memphis, Tenn., and Dr. J. Leland Boogher, St. Louis, Mo.

George F. Murphy, having completed the reorganization of the New York office of the Heine Boiler Company, St. Louis, Mo., has taken charge of the Philadelphia territory, with headquarters in the Pennsylvania building, Philadelphia, Pa.; Harold P. Childs, formerly special representative of the executive offices of the General Electric Company, New York, has been appointed manager of the New York City office of the Heine Boiler Company, with headquarters at 11 Broadway; J. R. Fortune, formerly manager of the Detroit office, has assumed charge of the territories heretofore covered by the Pittsburgh, Cleveland and Detroit offices, with headquarters in the Dime Bank building, Detroit, and in the Park building, Pittsburgh. The Cleveland, Ohio, office has been discontinued.

The Central Brake Shoe & Foundry Company, Chicago, has opened a sales office in that city at 247 Railway Exchange. The officers of the company are F. Van Inwagen, president; A. C. Deverell, vice-president, and R. E. Frame, vice-president. Mr. Van Inwagen has been connected with the Corn Exchange Bank of Chicago and prior to that time was in the manufacturing business. Mr. Deverell was formerly general superintendent of motive power of the Great Northern and more recently western sales manager of the Locomotive Stoker Company at Chicago. Mr. Frame has been sales agent for the Pullman Company and was formerly manager of sales for the Haskell & Barker Car Company, Michigan City, Ind. The company's plant is located at Clearing, Ill.

At a meeting of the stockholders of the Vanadium Corporation of America, New York, which was immediately followed by a meeting of the board, Alfred A. Corey, Jr., was elected president to succeed J. Leonard Replogle, resigned. Merrill G. Baker continues as vice-president and Lawrence K. Diffenderfer, treasurer, was elected also secretary to succeed E. F. Nickerson, resigned. Mr. Corey was elected also a director; other new directors include Frederic W. Allen, Samuel F. Pryor, William E. Corey and Payne Whitney to succeed Joseph De Wyckoff, Charles M. Walton, Jr., E. R. Tinker and Edward F. Nickerson, resigned, and Charles M. MacNeill, deceased. Alfred Adams Corey, Jr., the new president of the corporation, is an iron and steel manufacturer. He was born in North Braddock borough, Pa., on January 4, 1878, and was educated in the public schools. He served as an apprentice in the machine shops of the Homestead Steel Works, Carnegie Steel Company, from 1893 to 1895, and then for one year was with the Illinois Steel Company, Chicago. He again returned to the Homestead Steel Works where he remained until 1900; from 1900 to 1904, he was assistant superintendent of structural mill and assistant superintendent of open hearth department, then superintendent of open hearth department and rolling mills, North Sharon plant, Carnegie Steel Company. He served from 1906 to 1909, as general superintendent of the Donora Steel Works & Furnaces, Union Steel Company, Donora, Pa., then became assistant general superintendent of the Homestead Steel Works, later serving with the Carrie Furnaces and Schoen Steel Wheel Works, in 1914 becoming general superintendent of the same. He also served as president of the Cambria Steel Company, Johnstown Water Company, vice-president of the Midvale Steel & Ordnance Company and Union Coal & Coke Company.

Alfred A. Corey, Jr.

H. N. Winner, former manager of the packing department of the United States Rubber Company, and manager of the Philadelphia branch of the Garlock Packing Company, has been elected president and general manager of the Crandall Packing Company, Palmyra, N. Y. R. M. Waples, formerly in the packing department of the United States Rubber Company and the Garlock Packing Company, has been elected vice-president and treasurer and R. P. Engle of Palmyra, secretary of the Crandall Packing Company. E. P. Watrous, formerly manager of the New York branch of the Garlock Packing Company, is now manager of the New York branch of the Crandall Packing Company. I. D. Lyon, former manager of the Clinton Manufacturing Company and of the mechanical goods division of the Goodyear Tire & Rubber Company, is manager of the Birmingham branch of the Crandall Packing Company.

The W. N. Matthews Company, manufacturers of mechanical painting equipment and railway electrical specialties, St. Louis, Mo., has been reorganized as the W. N. Matthews Corporation, with the same headquarters. W. N. Matthews continues as president of the new company and C. L. Matthews as vice-president and secretary. C. C. Fredericks, general manager of the W. N. Matthews Company, has been elected vice-president and general manager of the new corporation, and A. G. Williams has been appointed manager of railroad sales. Mr. Williams started as a mechanical apprentice in the Altoona, Pa., shops of the Pennsylvania Railroad and was promoted through various positions to that of engineer of motive power of the Southwestern region, with headquarters at St. Louis, Mo., which position he resigned on May 1 to take charge of the railroad sales of the mechanical painting equipment of the W. N. Matthews Corporation, St. Louis.

J. P. Moses has been appointed general manager of railroad sales for Joseph T. Ryerson & Son, Inc., with headquarters in Chicago, to succeed H. A. Gray, who has resigned to enter another field of business. Mr. Moses has been in the service of the Ryerson company for a period of over 22 years and is well known in railway circles. For a number of years he specialized in high-grade refined iron known as Ulster special, which is used largely by the railroad companies for staybolt purposes. H. T. Bradley has been appointed manager of eastern railroad sales, with office in New York City, for Joseph T. Ryerson & Son, Inc., Chicago. Mr. Bradley has been serving the railroad field for many years in the east. He entered the service of the Ryerson company in 1906 and spent a great deal of his time as a sales engineer in the machinery department. For the past seven years he has been associated with the railroad division as assistant manager. Although the company sells a complete line of iron and steel products to the railroads, Mr. Bradley has concentrated his efforts largely on staybolt iron and special railroad machinery.

J. P. Moses

"Vibrac" Steel

A new steel called vibrac is being made in Manchester, England, which has the virtue of never tempering brittle and of being absolutely reliable in behavior under any normal treatment. According to the London Times the claim is made for this new steel that it not only responds to even higher mechanical requirements than nickel chrome steel, especially as regards elastic limit, but may, after tempering, be either air cooled or furnace cooled, thus entirely avoiding the risk of distortion, and will yet give higher impact values than nickel chrome steel treated under the most favorable conditions. Another advantage is that in large masses it has a uniform consistency throughout the mass.

TRADE PUBLICATIONS

CO_2 RECORDER ACCESSORIES.—Three devices, developed to prevent fouling and corrosion of CO_2 equipment and the tubing which conveys the gas sample to the instrument continuously, are described and illustrated in an 8-page bulletin, No. 166-A, which has recently been issued by the Uehling Instrument Company, Paterson, N. J. These devices are known as the Pyro-Porus filter, the gas dryer and the gas purifier.

WATERPROOFING METHODS AND MATERIALS.—A 32-page, illustrated, large-size bulletin has recently been issued by Gardner & Lewis, Inc., New York, with an enclosed set of specifications for the Karnak waterproofing manufactured by this company. The bulletin gives a detailed summation of the requirements of various technical societies for waterproofing as well as the results of numerous tests made by laboratories and consulting engineers. A table is included of a large number of railway and other bridge and building structures, showing the asphalt specifications at various temperatures and the cloth specifications for each structure. Considerable space is given to the discussion of the various classes of asphalts and membranes and their characteristics. Methods of construction are explained and illustrated for specific problems.

APPARATUS FOR DETERMINING STRESS DISTRIBUTION.—Designing engineers who have endeavored to study stress distribution in complex structures or machinery through the construction of flexible models, will be interested in a pamphlet issued by Adam Hilger, Ltd., London, England, describing Professor Coker's apparatus for accomplishing this result with the aid of polarized light. By using transparent celluloid models of the structure it is desired to investigate, the variation and intensity of stress is portrayed in the colors of the spectrum, and by comparing these colors with those of a "calibration member," subjected to known stresses, it is possible to analyze the action of complex structures under load to a degree of accuracy said to come within two per cent. The pamphlet is illustrated with photographs and diagrams of the equipment and also of specimens subject to test.

TOOL GRINDING MACHINES.—An instructive 20-page bulletin (No. 102) has recently been issued by the Greenfield Tap & Die Corporation, Greenfield, Mass. This bulletin, which is attractively prepared and illustrated, describes the principal features, giving specifications and details, of the plain cutter and reamer and universal grinding machines made by the Greenfield Tap & Die Corporation. An opening paragraph points out the importance of tool grinders, the succeeding pages being devoted to a description of the Nos. 160, 162, 184, 190 and Greenfield Nos. 1 and 2 machines for tool, cutter and general machine shop grinding. The Greenfield machines are the largest of the group, being of the universal type adapted to any kind of tool sharpening or toolroom grinding within their capacity. A complete list of the sizes, shapes and grades of grinding wheels is included in the bulletin. On the last four pages directions and illustrations are given of the method of setting up various types of reamers and cutters for grinding. Light cylindrical and surface grinding operations are also illustrated.

LOCOMOTIVE AND OTHER CRANES.—The Industrial Works, Bay City, Mich., has issued an elaborate catalogue of its products commemorating the completion of a half-century of its existence. This book is a very elaborate presentation of the products of this company and is profusely illustrated with photographs showing details of the equipment and the manner of its use. Preceding the catalogue section is an interesting history of the development of cranes from the days of the pyramids to the latest designs of the present day. This is followed by sections devoted to (1) locomotive cranes of rail, traction and crawling tractor types, and large, wharf and gantry cranes; (2) crane accessories, such as clam shell buckets, magnets and drag lines; (3) wrecking cranes ranging from 75 tons to 200 tons capacities; (4) special railway equipment, such as pillar and transfer cranes, portable rail saws and transfer tables; (5) pile drivers, pile hammers, etc., and (6) facilities for foreign service. In addition to considerable detailed information regarding the products of the Industrial Works, the book contains much information of general interest to all users of equipment of this character.

EQUIPMENT AND SHOPS

Locomotive Orders

The Greenbrier & Eastern has ordered one 2-8-0 type locomotive from the Baldwin Locomotive Works.

The Norwood & St. Lawrence has given a contract to the American Locomotive Company for a 2-6-0 type locomotive of 125 tons.

Caminhos de Ferro de Lourenco Marques, Portuguese East Africa, has ordered two 4-6-2 type locomotives from the Baldwin Locomotive Works.

The New York Central has ordered 15 locomotive tenders from the Lima Locomotive Works, and also placed an order for 20 with the American Locomotive Company. These tenders are to have a capacity of 15,000 gal. and will have six-wheel trucks.

Locomotive Repairs

The Missouri Pacific will convert 104 locomotives into oil burners.

Passenger Car Orders

The Erie has placed an order for 44 steel suburban coaches with the Pressed Steel Car Company.

The Wabash has ordered one steel private car from the American Car & Foundry Company.

The Central Vermont has ordered two steel 55-ft. combination passenger smoking and baggage storage battery cars, equipped with Edison batteries, from the Railway Storage Battery Car Company, New York.

Freight Car Orders

The Norwood & St. Lawrence has placed an order for 35 freight cars.

The Montour Railroad has ordered 500 cars from the Standard Steel Car Company.

The Minnesota Steel Company has ordered 20 flat cars from the Standard Steel Car Company.

The Minnesota Steel Company has ordered 44 hopper cars from the Pressed Steel Car Company.

The Elgin, Joliet & Eastern has ordered 500 steel underframes from J. G. Heggie & Sons, Joliet, Ill.

The Union Pacific has ordered 200 tank cars of 12,500 gal. capacity from the Standard Tank Car Company.

Swift & Co., Chicago, has ordered 100 steel underframes for refrigerator cars from the Bettendorf Company.

The Atchison, Topeka & Santa Fe has ordered 300 gondola cars and 200 flat cars from the Pullman Company.

The Standard Oil Company of New Jersey has ordered 10 center bottom dump cars from the American Car & Foundry Company.

The New York Central has ordered 500 hopper car bodies of 55 tons' capacity from the Merchants Dispatch Transportation Company.

The Baltimore & Ohio has ordered 100 four-wheel steel tie cars and 15 four-wheel piling cars from the Pressed Steel Car Company.

The Bradford Oil Refining Company, Bradford, Pa., has ordered 5 tank cars of 8,000 gal. capacity from the General American Tank Car Corporation.

The Cuba Cane Sugar Corporation has ordered 35 cane cars of 30 tons' capacity from the American Car & Foundry Co., and 25 cane cars of 15 tons' capacity from the Koppel Industrial Car & Equipment Company.

The New York, Ontario & Western has placed an order with the Pressed Steel Car Company for 16 steel underframes with superstructures, for caboose cars, to be built in the railroad company's shop at Middletown, N. Y.

Freight Car Repairs

The Norfolk & Western has arranged for the repair for 500 hopper cars of 57½ tons' capacity with the Ralston Steel Car Company and 500 with the Virginia Bridge & Iron Company.

The New York Central will have repairs made to 500 box cars in the shops of the Ryan Car Company, and repairs to 200 box cars made in the shops of the American Car & Foundry Company.

The Central of New Jersey has arranged for the repair of 600 cars as follows: For 200 with the American Car & Foundry Company, 200 with the Pressed Steel Car Company and 200 with the Standard Steel Car Company at its Middletown works.

The Chesapeake & Ohio has arranged for the rebuilding of 500 steel coal cars of 55 tons capacity, as follows: To the Newport News Shipbuilding & Drydock Company, Newport News, Va., 250 cars and to the American Car & Foundry Company, Huntington, W. Va., 250 cars.

Machinery and Tools

The Seaboard Air Line has placed an order for two 100-ton bushing presses.

The Pennsylvania has placed an order for a 90-in. wheel quartering machine.

The Central of New Jersey has placed orders for a locomotive axle journal turning lathe and a car wheel borer.

The Southern Pacific has placed an order for a 36 in. by 18 ft. lathe, and for an axle lathe.

The Central Vermont has placed an order for a 36 in. by 17 ft. lathe, also for a 5 ft. radial drill.

The Elgin, Joliet & Eastern has placed orders for a 30-in. planer, an axle lathe, a car wheel lathe and a 44-in. boring mill, and has ordered one turret lathe from William Powell Company, Cincinnati, Ohio.

Shops and Terminals

Oregon Short Line.—This company will erect a new 650-ton coaling station at Glens Ferry, Ida.

St. Louis South Western.—This company will erect a 200,000 gallon capacity oil storage tank at Jonesboro, Ark.

Chesapeake & Ohio.—This company will construct a new engine house and additional tracks in its yard at Russell, Ky.

Western Fruit Express.—This company will construct a general car repair shop at St. Paul, Minn., to cost approximately $150,000.

Spokane, Portland & Seattle.—This company will construct a new blacksmith shop, 50 ft. by 90 ft., at Vancouver, Wash., to cost $30,000.

New York, Chicago & St. Louis.—This company plans the construction of a new repair shop, a roundhouse and other terminal facilities at West Frankfort, Ind.

Chicago, Milwaukee & St. Paul.—This company has awarded a contract to Jos. E. Nelson & Sons, Chicago, for the construction of water treating plants at Bensonville, Ill., and Mannheim.

Southern Pacific.—This company has completed plans for the construction of a one-story machine shop, 85 ft. by 498 ft., in Los Angeles, Cal., to cost approximately $390,000 with equipment.

Chesapeake & Ohio.—This company has awarded a contract to Joseph E. Nelson & Sons, Chicago, for the construction of water treating plants at Foster, Ky., Edgington, Stony Point, South Portsmouth and Maysville.

Alabama & Vicksburg.—This company has awarded a contract to the Truscon Steel Company, Youngstown, Ohio, for the erection of a steel repair shop, 208 ft. by 64 ft. at Vicksburg, Miss., to cost approximately $57,000.

ST. LOUIS-SAN FRANCISCO.—This company has awarded a contract to the Howlett Construction Company, Moline, Ill., for the construction of a 300-ton, three-track, reinforced concrete coaling station at the Lindenwood yard, St. Louis, Mo.

PENNSYLVANIA.—This company has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of a 700-ton reinforced concrete coaling plant with duplicate elevating equipment and a 120-ton gravity sand plant for installation at Conemaugh, Pa.

WABASH.—This company has awarded contracts to Townsend B. Smith, Decatur, Ill., for the erection of an addition to its locomotive repair shop at Seventh street, St. Louis, Mo., at a cost of approximately $175,000, including equipment, and for the addition to its shops at Decatur, Ill., to Townsend B. Smith, Decatur, Ill., at an approximate cost of $175,000.

ILLINOIS CENTRAL.—This company has awarded a contract to Joseph E. Nelson & Sons, Chicago, for the construction of water treating plants at Dixon, Ill., and Panola; and to the Graver Corporation, Chicago, for the construction of water treating plants at Parkersburg, Iowa; Iowa Falls, Webster City and Marcus. A contract has also been awarded to the Railroad Water & Coal Handling Company for the construction of a 300-ton coal chute at Dubuque, Iowa.

PERSONAL MENTION

General

WILLIAM G. KNIGHT has been appointed mechanical superintendent of the Bangor & Aroostook, succeeding Laird W. Hendricks, deceased.

J. W. HIGHLEYMAN, superintendent of shops of the Union Pacific, with headquarters at Cheyenne, Wyo., has been promoted to assistant superintendent of motive power and machinery, with headquarters at Omaha, Neb.

WILLIAM H. FETNER has been appointed assistant to the president of the Missouri Pacific. Mr. Fetner was born at Columbia, S. C. He began railway service with the Illinois Central, serving an apprenticeship in their shops at Water Valley, Miss. After completing his apprenticeship, he was engaged as shop foreman and locomotive engineer with the old Richmond & Danville, now a part of the Southern. He entered the service of the Central of Georgia on October 6, 1892, serving as gang foreman, erecting shop foreman and then general foreman. In 1904 he was promoted to the position of master mechanic at the Macon, Ga., shops, serving in that capacity until January, 1916, at which time he was appointed general master mechanic. On November 16, 1917, he was promoted to superintendent of motive power, which position he held until his resignation on July 15, 1923, to accept service with the Missouri Pacific in the above capacity.

W. H. Fetner

W. J. O'NEILL, superintendent of motive power of the Second district of the Chicago, Rock Island & Pacific, with headquarters at El Reno, Okla., has been appointed general mechanical superintendent of the Denver & Rio Grande Western with headquarters at Denver, Colo. W. W. Leman, superintendent of motive power and car department of the Denver & Rio Grande Western, with headquarters at Denver, Colo., has resigned and the office of superintendent of motive power and car department has been abolished.

Master Mechanics and Road Foremen

B. KOONTZ has been appointed assistant road foreman of engines of the Seaboard Air Line, with headquarters at Hamlet, N. C.

B. H. DAVIS has been appointed master mechanic of the Delaware, Lackawanna & Western with headquarters at Scranton, Pa.

H. C. CASWELL has been appointed master mechanic of the Delaware, Lackawanna & Western with headquarters at Binghamton, N. Y.

JOHN LOVE has been appointed assistant master mechanic of the Lehigh & Susquehanna division of the Central of New Jersey with headquarters at Mauch Chunk, Pa.

J. D. YOUNG has been appointed master mechanic of the Lehigh & Susquehanna division of the Central of New Jersey with headquarters at Ashley, Pa., succeeding A. B. Enbody, deceased.

W. R. KEITHLEY and MONROE BRITTIAN have been appointed road foremen of equipment of the Arkansas-Louisiana division of the Chicago, Rock Island & Pacific, with headquarters at Little Rock, Ark., to give special attention to the operation of oil-burning locomotives.

C. B. ROGERS, whose appointment as general master mechanic of the Minneapolis & St. Louis at Marshalltown, Iowa, was announced in the September issue of the *Railway Mechanical Engineer*, was born at Newport, England, December 17, 1873. He attended the Kendrick School for Boys, Reading, England, also the grammar grades in the United States, entering the employ of the Burlington, Cedar Rapids & Northern at Esterville, Iowa, in 1892. From 1895 until October, 1917, he subsequently served as locomotive fireman, Iowa Central; locomotive fireman, Atchison, Topeka & Santa Fe; locomotive engineer, Iowa Central; locomotive engineer, Minneapolis & St. Louis; air brake instructor, International Correspondence Schools, and road foreman of engines, Minneapolis & St. Louis. From October, 1917, to January, 1921, he was in government service with the Engineering Corps in Siberia. In November, 1921, he was promoted to assistant master mechanic of the Minneapolis & St. Louis at Ft. Dodge, Iowa, and in June, 1922, became master mechanic of the Central and Western divisions with headquarters at Minneapolis, Minn.

HENRY HARLEY URBACH, assistant master mechanic of the Galesburg division of the Chicago, Burlington & Quincy with headquarters at Galesburg, Ill., has been promoted to master mechanic of the Brookfield division, with headquarters at Brookfield, Mo., succeeding D. R. McGrath, who has been assigned to other duties. Mr. Urbach was born on February 4, 1890, at Sutton, Neb., and attended high school at Liovett, Neb., entering the employ of the Chicago, Burlington & Quincy on February 18, 1907, as a machinist apprentice at Havelock, Neb. Completing his apprenticeship in July, 1912, he served as a machinist in the same shop until July, 1914, when he was transferred to Alliance, Neb. In August, 1914, he was transferred to Edgemont, S. D., and in April, 1915, became roundhouse foreman at Seneca, Neb. He was transferred as roundhouse foreman to Alliance in March, 1917, being appointed general foreman at Edgemont in November, 1917; general foreman at Alliance, in December, 1918, and general foreman at Denver, Colo., in October, 1920. In May, 1923, he became assistant master mechanic at Galesburg.

Shop and Enginehouse

C. W. CULVER has been appointed works manager in charge of the locomotive and car shops of the Central of New Jersey with headquarters at Elizabethport, N. J.

Purchasing and Stores

C. F. POST, assistant purchasing agent of the Western Pacific, with headquarters at San Francisco, Cal., has been promoted to purchasing agent, with the same headquarters, succeeding W. T. Jacobs, deceased.

C. C. DIBBLE, supervisor of stores of the New York Central with headquarters at Indianapolis, Ind., has been appointed general supervisor of stores with the same headquarters. The position of supervisor of stores has been abolished.